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FEATURES



REGULARS

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DATA STATEMENTS

The Race is On!

CODEMASTERS ARE PREPARING to launch perhaps the strangest PR stunt of the year, admittedly, it's in a good cause though. The game, *The Race Against Time* will be the first game written specially for charity, and will be officially launched on LWT's Get Fresh program. All proceeds are to go to Sport Aid '88.

Codemasters also announced a free prize draw last month, entry forms are available from W.H. Smiths, John Menzies and other software outlets, no purchase is necessary, and the prize is an Amiga computer! The draw will take place on 18th August this year.

Touchline:
Codemasters: *1 Beaumont Business Centre, Beaumont Close, Banbury, Oxon OX16 7RT.*



Scott to market Citizen's ldc's and fdd's

SCOTT ELECTRONICS LIMITED are to market and distribute Citizen's new ranges of liquid crystal displays and floppy disk drives, launched at the Electronic Product Design Show, Olympia, last month. Their latest range of leading edge LCD displays incorporate fluorescent backlighting, giving increased contrast and viewing angle making them ideal for portable computers. Also on show are Citizen's latest 3.5″ floppy disk drives, with an unformatted capacity of 2Mb and a competitive price tag.

Touchline:
Citizen: *Wellington House, 4-10 Cowley Rd, Uxbridge, Middx UB8 2XW.* ***Tel:*** *0895 72621.*



Vixen: Foxy lady of Granath

MARTECH SHOWED THEIR appreciation to the gentlemen of the press last month. Around 30 faces (more than one sporting a MCP tie) were wined, dined and entertained at the launch of their latest game, *Vixen*. Martech appear to have pulled out all the stops on this one, even to the extent of hiring a model to pose in leopard skins, presumably as an added incentive to the aforementioned members of the press!

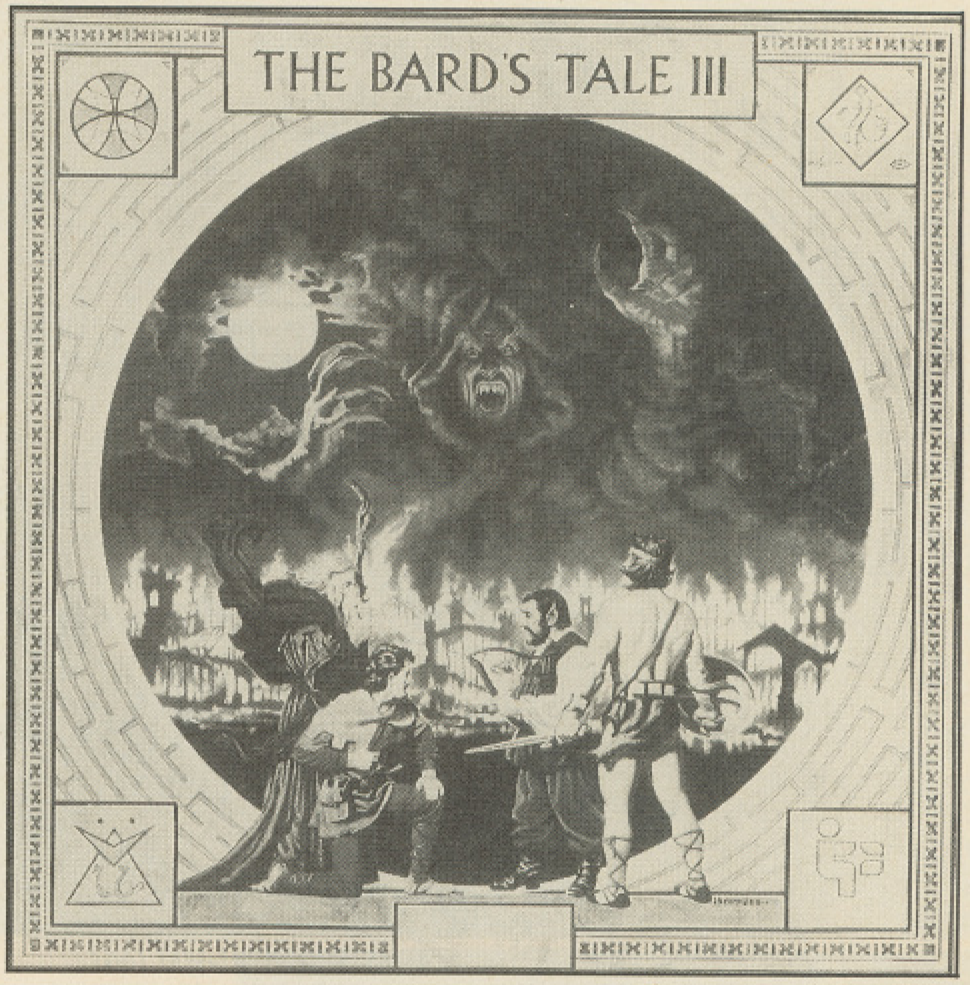
The game itself features a leopard-skin clad heroine in a role not dissimilar to Martech's Tarzan epic of last year. "The planet Granath has been under siege for as long as the sky has met with the horizon and as long as the mountains have rolled into the distance" reads the bumph. "For millions of years dinosaurs roamed the planet's surface in search of prey, and have destroyed all but a few of the mammals, and all of the humans – or have they?"



"Our lone heroine, *Vixen*, was raised by wily foxes and has magic powers. With her ability to change into a fox and her magic whip in hand, she is fierce, brave and a match for any of her foes." I'm sure you get the drift.....

Touchline:
Martech: *Martech House, Bay Terrace, Pevensey Bay, East Sussex BN24 6EE.* ***Tel:*** *0323 766616.*

DATA STATEMENTS



Thief of Fate

THE LATEST INSTALLMENT in the Bard's Tale series has arrived. The third in the series of award-winning medieval fantasy role playing games will feature more spells, more monsters and more dungeons than its predecessors. In *Bard's Tale III*, the fabled city of Skara Brae has been left in ruins. As the townsfolk celebrated a victory over the evil Mangar (the objective of Bard's Tale II), his master, The Mad Dog Tarjan, arrived seeking revenge and reduced the town to rubble. Skara Brae is only the first in a long line of cities which Tarjan has threatened to destroy. The rest is up to you.

Touchline:
Electronic Arts: *Langley Business Centre, 11-49 Station Road, Langley, Nr. Slough, Berks SL3 8YN.* ***Tel:*** *0753 49442.*

Mandarin Extends their Umbrella

MANDARIN PUT ON A display of Chinese hospitality for the press last month. The occasion? The signing of two new software houses, Red Rat of Manchester and Jawx of Paris, bringing the total sharing Mandarin's umbrella to five.

Red Rat are being hailed as Britain's brightest software houses, with many titles for the Atari ST to their credit, Amiga games are now high on their list of priorities.

The gents from Jawx demonstrated STOS (literally ST Operating System), a games development system for the Atari ST. An Amiga version is planned for later this year; will it be called AMOS?

"Our latest agreements are part of the grand plan to ensure we establish ourselves as the leading entertainments label" said Chris Payne, desperately trying not to look silly while dressed in oriental garb (the droopy moustache was a dead give-away).

Touchline:
Mandarin Software: *Europa House, Adlington Park, Adlington, Macclesfield SK10 4NP.* ***Tel:*** *0625 878888.*

MANDARIN SOFTWARE

Elite go Beyond the Ice Palace

BEYOND THE ICE PALACE is a game of magical fantasy, your quest is to rid the forest of evil spirits and return the land to peace and normality. Only time will tell whether this will notch up another hit for Elite.

Touchline:
Elite: *55 Bradford Street, Walsall WS1 3QD.* ***Tel:*** *0922 55852.*

National Hotline

ONE OF THE PROBLEMS facing some laser printer owners is tracking down toner cartridges. Derbyshire-based National Computer Supplies is now operating a telephone hotline to identify and supply the type of cartridge required for any make of laser printer, with guaranteed next day delivery.

Touchline:
National Computer Supplies: *0332 883333.*

DATA STATEMENTS

Gremlin Get their Skates On!

TIRED OF RACING and flying simulators? Try Gremlin's roller skate simulation! The game features skating poser Freddy in an attempt to gain all important 'Street Cred' by attempting posy feats. Points gained on the 'Cred-o-meter' are offset by the 'Ouch-o-meter', measuring bumps and grazes..... Let's hope the game has more to it than this!

Also due for release is *Blood Brothers*. The brothers, Hark and Kren come from a distant planet, plundered by other aliens. Their task is to recover the gems.....

Touchline:
***Gremlin:** Alpha House, 10 Caner Street, Sheffield S1 4FS. **Tel:** 021-356 3377.*

MP to open Epson factory

TELFORD, THE SITE of Epson's new printer factory, plays host to a truly international affair. Nicholas Ridley MP, Secretary of State for the Environment joins top Epson personnel for the ribbon cutting ceremony, following which a dozen printers will be donated to local organisations. The factory occupies 55 acres in Hortonwood, Telford, and is already churning out 30,000 printers each month.

Touchline:
***Epson (UK) Ltd:** Dorland House, 388 High Road, Wembley, Middlesex HA9 6UH. **Tel:** 01-900 1661.*

Virgin Manager



BRYNN GILMORE TAKES over as General Manager of Virgin Games. "Obviously I'm delighted with the move," he said, "it's a great company with a great future." Nothing like getting off to a good start is there?

Touchline:
***Virgin:** 2-4 Vernon Yard, Portobello Road, London W11 2DX. **Tel:** 01-727 8070.*

Microprose team up with Cosmi

BIRMINGHAM BASED US GOLD lost out on a nice little earner when top US publisher Cosmi entered into a joint venture with Microprose. Microprose will be responsible for marketing Cosmi's latest projects. Defcom 5, The President is Missing and in the future, Super Huey III, in Europe and Australia.

Touchline:
***Microprose:** 2 Market Place, Tetbury, Gloucestershire GL8 8DA. **Tel:** 0666 54326.*

YER RS232

YORK ELECTRONIC RESEARCH could be the answer to many of our prayers. This two-man team specialising in communications and utility products for Commodore computers have the time and experience to provide a level of customer support unthinkable from any highstreet shop!

As RS232 became adopted as the standard for serial communication, it became interpreted differently by different manufacturers. The end result being confusion, the term 'standard' losing a lot of meaning. This manual helps explain the complexities of RS232, and will be of use to anyone with a MODEM or a serial printer. Included in the manual are hints and tips for programmers, telephone numbers for bulletin boards as well as information on hardware connections. A telephone call to YER is all that is necessary to alleviate any persistent problems, indeed they seem to welcome problem printers! Good luck to YER!

Touchline:
***York Electronic Research:** The Fishergate Centre, 4 Fishergate, York YO1 4AB. **Tel:** 0904 610722.*

Games Update

This month's releases are dominated by old games, as re-released titles continue to storm the charts



International Soccer

The re-releases usually appear in the massed ranks of the budget labels but we'll start this update with news of the reappearance of International Soccer.

This all time classic C64 football game was one of the first when it appeared on a Commodore cartridge and then starred in countless shop windows advertising the features of the "new amazing C64". Now at last it has made the move to cassette and disk via CRL with the only changes being different names on the advertising boards that line the pitch.

The Archon Collection features two of the best Electronic Arts strategy games on one disk. The original Archon features a chess board and two armies of pieces facing each other in a battle between light and dark. Each piece is a different monster ranging from unicorns to basilisks and goblins to trolls and possessing different strengths and weaknesses. Although the board may look like a chess board that's where the similarity ends as in Archon; if you want to take a piece, you have to fight for it on a separate battlefield.

In Archon II the board has been altered to depict the four elements of air, earth, fire and water and the players are sorcerers that conjure up monsters, demons and elements to win control of the game.

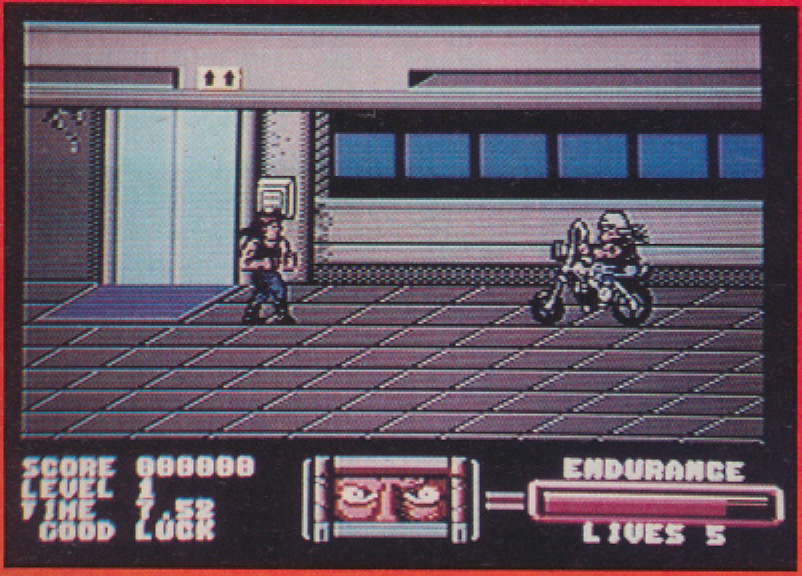
Arcade Force Four from US Gold is a compilation for players who like to shoot before they think. For only £9.99 the pack includes four coin-op conversions in which you can delve deep into all 1024 levels of Gauntlet and the Deeper Dungeons, race against the clock in Metrocross, experience cartoon capers as the Road



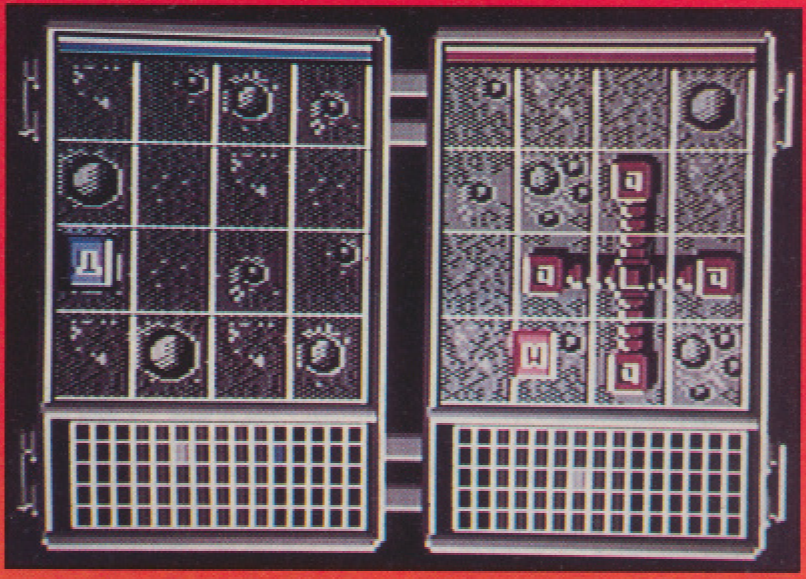
Archon II



Road Runner



Target Renegade


Corporation

Runner and explore the Temple of Doom as Indiana Jones.

Arcade Alley (also from US Gold) contains six Dataeast coin-op conversions for the price of one in which you can beat 'em-up in Kung-Fu Master, Tag Team Wrestling, Karate Chop and Express Raider and then shoot 'em-up in Breakthru and Last Mission.

IO is what Firebird claim is the slickest fastest shoot 'em-up ever! Armed with a single shot laser blasting ship you must travel through the Nemesis style screens collecting green orbs that increase your fire power or can be shot to turn them into screen clearing smart bombs. Once you've trebled your firepower, further orbs protect and save you lives. Although it's fast and pretty it leaves you thinking you've seen it all before.

Target Renegade (Imagine) is the sequel to the street fighting beat 'em-up Renegade in which you're out for revenge. Your brother has been killed by Mr. Big and you're determined to get even, so armed with your joystick controlled punches, leaps and kicks you take on five levels of thugs. This all begins in a multi-storey carpark with a scrap with a motorbike gang and then on through a seedy street, park, a meeting with the Beastie Boy fans in the shopping mall until you have a final battle with Mr. Big. Forget the rules on etiquette in this game – they fight dirty. To win you'll have to be even tougher.

Microleague Wrestling (imported by Microprose) sets out to recreate the thrills and spills of American Style wrestling and the antics of the former world champion Hulk Hogan. Although two opponents are supplied on disk and the game features digitised graphics, the game is repetitive and somewhat uninspiring. Unlike other joystick controlled games, Microleague Wrestling leaves you outside the ring, occasionally selecting a move that may succeed and then waiting as the result is loaded in from disk.

Activision's Corporation is set in a world ruled by two corporations and you lead a mining team against a similar team from another side. Your task is to mine as much Minorthian crystal as possible while hindering your opponents operation. Despite some excellent introductory screens the game leaves you staring at the screen for too long, to make this one worth considering, even for dedicated fans of strategy games. Perhaps you could use the "free mapping grids" in a game of battleships while the computer plays itself!

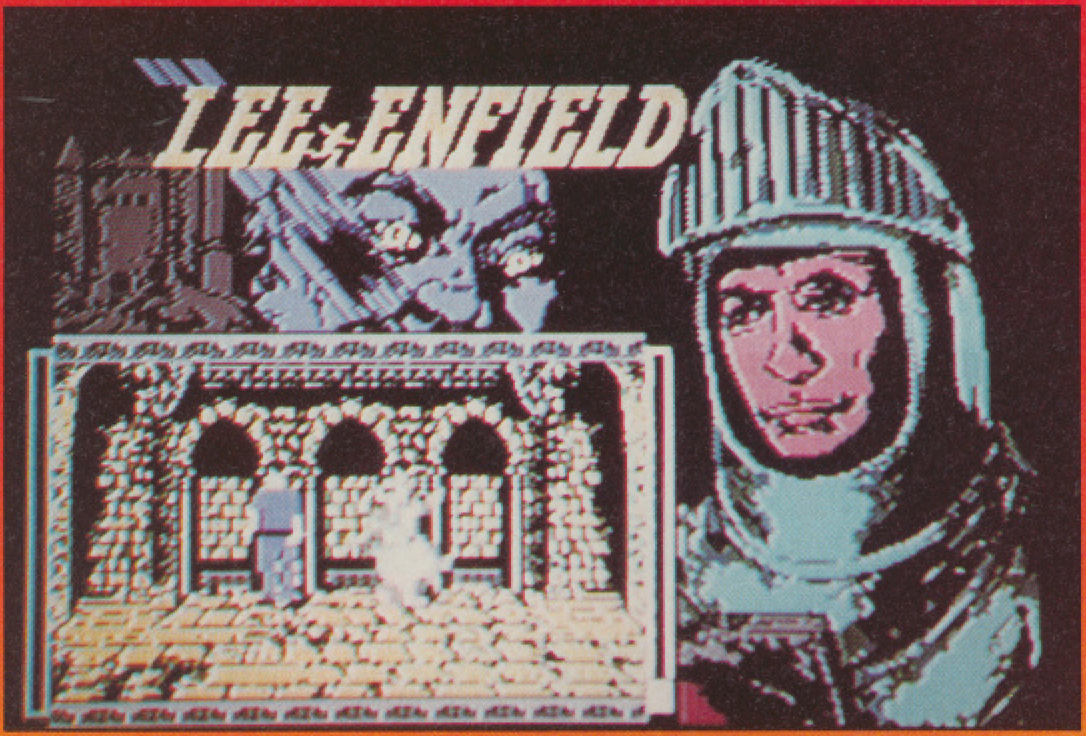
The plot of Ocean's latest release Gutz is certainly original as you're sent to make contact with an approaching alien. Unfortunately, it's an incredibly hungry ten million tonne mega being, the size of a small moon who promptly eats you. Your only way out is to destroy its major organs but first you will have to survive the constant onslaught of the aliens defences, navigate through the maze of arteries, find suitable weapons and then destroy each organ in turn. Sadly, Gutz falls short of its billing, as the alien's body looks like the setting of several other arcade adventures and you're left with an average arcade adventure.

Gothik (Firebird) is the latest in a long line of Gauntlet clones in which you must restore your master, the supreme wizard Argoth, who has been slain by the evil arch mage and his body and soul dispersed in the catacombs you are about to explore. To



Gutz


Gothik



Tournament of Death

help or hinder you in your quest are 32 different potions that will temporarily speed you up, slow you down, halves damage, destroy walls in your path and heal your wounds to name but a few. No sooner have you drunk your first potion and slain your first shapeless monster that you're overcome by a feeling that you've seen and done this before.

The Tournament of Death is the second in Infogame's Time Trouble shooter series of games. In this game the here Lee Enfield has travelled back to the 13th century to save the Holy Shroud from the Yellow Shadow who plans to destroy it. The game features some nice graphics and is an interesting arcade adventure but is spoiled by its waggle-as-fast-as-you-can system.

Budget Games

The Power House has re-released four former full-priced US Gold games as part of its new range.

Dambusters was one of the original "mega games" and re-enacted the famous raids made by Guy Gibson's Lancaster bombers. However, the games casts you as pilot, navigator, engineer, gunner and bomber as you battle your way through enemy lines, flak and fighter planes and into your bombing run where your speed, height and timing must be perfect to get the bomb to bounce to the target.

Fight Night tests your pugilistic prowess against five of the toughest boxers each with their own style and character. Joystick moves allow you to move your guard, fake jabs and throw punches, but watch out for some tricky moves from your opponents including a vicious upper cut.

Grog's Revenge is the sequel to BC's quest for tires and stars the stone-age hero in search of the meaning of life. This is kept hidden away in a maze of mountains and joined by toll-bridges charging claims you haven't got and patrolled by Tiredactyls who will pinch your wheels.

The fourth from the Power House puts you in a duel in the dunes in Desert Fox. Your mission is to protect fuel depots from enemy attack as you drive your tank through minefields and slug it out with enemy tanks, aircraft and Rommel himself.

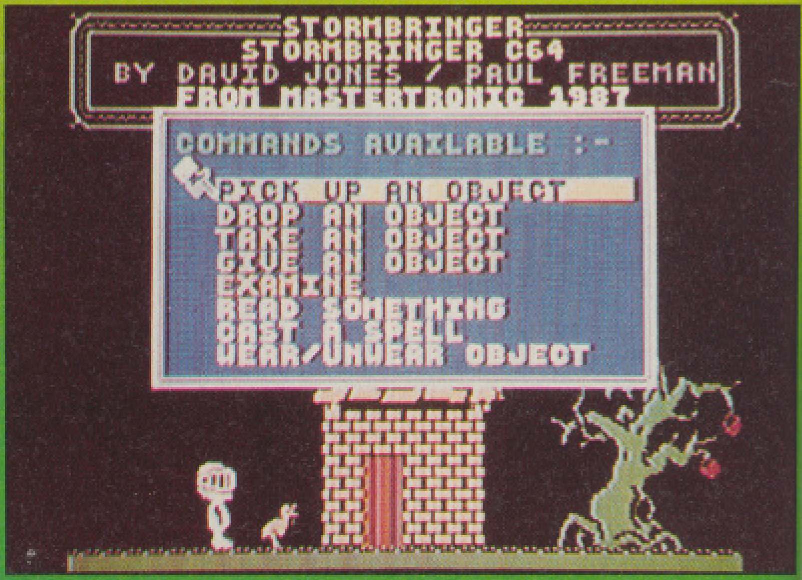
For a change of pace why not try out Trailblazer (Mastertronic). Formerly, from Gremlin Graphics the game tests your reflexes to their limits as you must guide a ball along a course that hurtles out of the screen towards you at breakneck speeds. Different coloured squares lie in your way to perhaps help you bounce over a void by giving you a burst of energy, or hinder your progress by slowing you down so you miss the time limit and end the game.

Stormbringer (Mastertronic MAD) is the third and concluding episode in the superb Magic Knight trilogy continuing the adventures that began in Spellbound and continued in Knight Thyme. This time magic Knight is in big trouble as he has been cloned while transporting back in a second-hand time machine. Now his other self, the evil Stormbringer of the title is out to get him. Using the now familiar, but still impressive, windimation system you must save the day.

Finally, a word from the "it had to happen sometime dept" as the last budget release is in fact a compilation! Top Ten's Bogies Pick 2 (inferring there's more where this game came from) contains four games for only £2.99 including Herbert's Dummy Run, Black Hawk, Mad Doctor and Slurpy. YC



First Night



Stormbringer

Handy Input Routines

Have you ever wondered how you could make your Basic programs more idiot-proof and more professionally presented? Here's your chance with two routines – both written in straightforward Basic with not an SYS in sight!

By Norman Hart

This routine allows the programmer to restrict a user's input in such a way that the input is pre-defined (i.e. characters for names, integers for telephone numbers of a mixture of both for postal addresses); the maximum length of the input is pre-defined between 1 and 38 keystrokes; the tabulation on screen is pre-defined; the string variable returned is no longer than necessary, and even removes a space from the end of a string if it was accidentally included; formalises the input by allowing no spaces at the beginning of the string, and only one space between words in the string. This can be over-ridden if you wish; the string length is instantly available on return.

The routine is fairly short, being only 21 lines long, and in this case starts at line 200. To use, define the variables RS (the restriction), L (the maximum string length), and TB (the tabulation) before calling the routine. As regards the character restrictions allowed, these are defined between lines 240 and 260 and can be tailored to suit your needs. Even single keystroke commands can be added (between lines 220 to 240) to increase flexibility; try adding this line.

```
235 IFX$=CHR$(211)THENPRINT"[CLR
,DOWN3]SAVE[UP3]":POKE631,13:POK
E198,1:END
```

By keying in shift/s you can instantly save your entire program.

If you need to make use of the length of the string, then the variable A is the equivalent to LEN(Y$).

Do remember after returning, that you can always redefine Y$ as follows:

GOSUB 200:A$=Y$:GOSUB 200:B$=Y$

As I have already mentioned, the SPACE character is very restricted in how it can travel, and you may feel that this is unsatisfactory for your needs. If this is the case, then two options are open to you. Firstly, the shift/SPACE is unaffected and essentially has the same effect as an unshifted/SPACE as far as the visual appearance of the string is concerned. But be very careful! A shifted/SPACE has a different ASCII value to an unshifted/SPACE and would most likely cause problems if you are using the returned string for searching through data files. A better solution perhaps would be to erase all references to the variable SP (i.e. delete SP instructions in lines 200, 330, 370 & 380), or more simply, delete or REM out line 380 only.

Cursor Controlled Menu

Now for the second routine, a little shorter than the first, but every bit as useful in its own way.

The program allows the user to select any defined part of a menu by moving a custom-designed cursor up and down a pre-set vertical path. Pressing the RETURN key makes the selection.

To use the routine you must first define the variables – study line 360.

LL: The limit of the cursors vertical travel. This must be set in conjunction with an initial cursor positioning.

LN: The length of the string returned. This is achieved by reading the screen (OPEN 1,3) at line 580. Maximum number of characters – 255!

T1: The horizontal positioning of the cursor.

T2: The horizontal start of the reading routine (line 580).

The information returned is in the form of a string variable Y$ and a vertical cursor position (variable A). The string can always be redefined on return, but perhaps more interesting, the cursor position (variable A) can be used to branch out to various parts or routines in the rest of your program, for example:

ON A+1 GOTO 1000,2000,3000

Although the routine is fairly straightforward, to start with, I strongly suggest that you type in the program as shown in lines 240 to 330, 360 to 390, and 500 to 590. Again, take great care with the cursor symbols in lines 520, 540, 550, and 560, and if you're not happy with the >CHR$(62) cursor, then it can be changed to any symbol you choose.

Finally, the best way of getting to grips with this routine is to alter the variables at line 360 and note the results. YC

See listings on page 74.

Solid Gold

If you thought that a printer interface was just something that was used to send text to a printer, think again

By Stuart Cooke

If, like a great majority of Commodore computer owners, you own, or are thinking of buying, a non-Commodore printer, you are probably already aware that you will need some sort of interface.

Most of the popular makes of printer have what is called a Centronics interface built into them as standard. It's not worth going into the technicalities of just what a Centronics interface is within this article, suffice to say it is totally different to Commodore printers.

There are two ways that you can hook up a Centronics interface. The first is to have a ribbon cable attached to the user port of the computer and the other end going to your printer. A small piece of software has to be loaded into the computer so that data for the printer is sent through the user port rather than through the normal Commodore serial port. This is the cheapest form of interface – however, it is extremely limited and will not work with a large number of programs.

The more expansive option is by far the best. This consists of a box of electronics that translates from Commodore serial to Centronics. At the Commodore end, the interface plugs into the normal serial port. The other end of the interface has a standard Centronic plug that goes into your printer. In use no alterations have to be made to the computer software since data is being sent to the normal output socket of the computer.

With this sort of interface, as with everything else, you get what you pay for. The cheaper ones can be used simply to send text to the printer. The more expensive ones actually make your printer behave like a standard Commodore printer, while still allowing you to use extra features supported by the printer.

Xetec, an American company, has taken things even further and produced the Super Graphics Gold interface. They claim that it is 'the ultimate printer interface for Commodore computers'. To be totally frank, I have to agree with them!

Gold Features

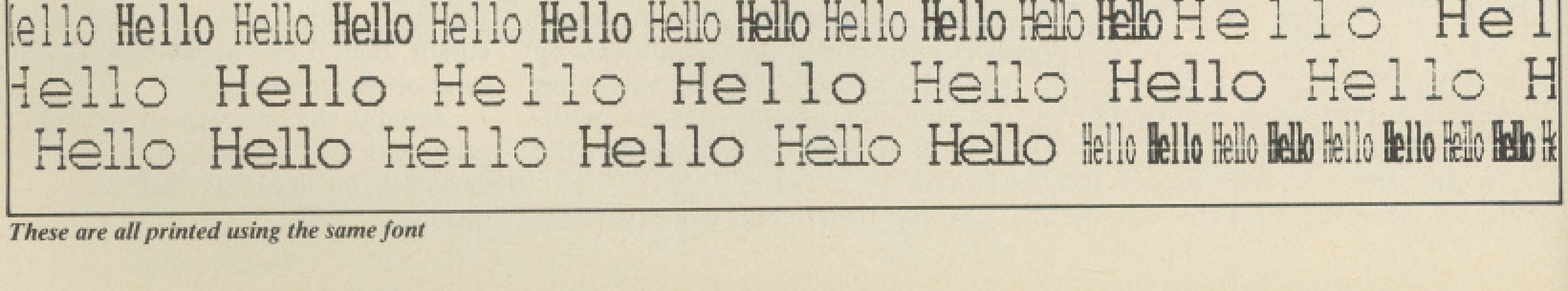
Before I explain the intricate details of this interface I will give a brief list of its features. I'm sure that this will whet the appetite of any printer owner.

- 32K RAM buffer
- 4 internal screen dumps
- 4 built in fonts
- 4 fonts can be downloaded from disk
- Bold, italics, double height etc. Supported in all fonts
- Can use fast serial on a C128
- Command channel with more than 52 commands
- Commodore 1525 emulation
- Plus lots more...

As you can see the Bold interface has a large arsenal of features inside its box.

Getting It Ready

Before you can start to use the interface, you need to give it information about how you want it to work. Most of this is done through a series of DIP switches on top of the interface. The function of these is marked on the interface as a quick reference. One handy feature is the fact that the switches are monitored at all times, thus they can be altered as required.



These are all printed using the same font

Switches allow you to select the following:

The type of printer that you are using. Settings for 37 different printers are listed in the manual. I found that I could find settings to suit all of the printers that I tried the interface with.

The width of your printer carriage, 80 or 132.

What device number you want your printer to use, 4 or 5.

What to do with line feeds, nothing, add one, strip one or strip and add.

Font enable allows you to use one of the 8 possible fonts. Switches are used to determine the font that you wish to use.

Enhance determines whether the printer prints out in the quickest, but poorish, way or the slowest but highest quality.

The group of three mode switches allows you to select just how the interface behaves. It can:

Emulate a Commodore 1525 printer so that all programs work correctly.

Be in Gold mode, where all features of the interface are available.

Super graphic mode makes the interface act like an earlier interface from Xetec.

ASCII conversion changes all text into their normal ASCII equivalents. All other codes remain the same.

Hex Monitor prints all characters sent to the printer as their hex equivalents.

Decimal performs the same as above but with decimal numbers rather than hex.

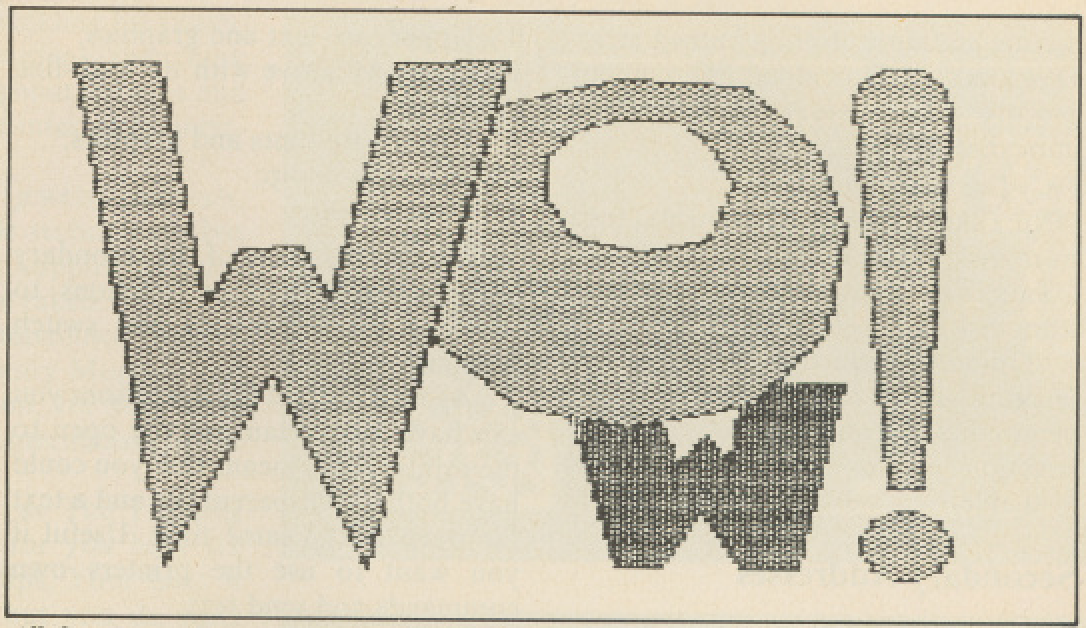
Semi-transparent passes all data straight through the interface unless you have turned a font on, in which case printing will be in the selected font.

Transparent sends everything through to the printer unchanged. Only the linefeed switches on the interface have any effect on what is printed.

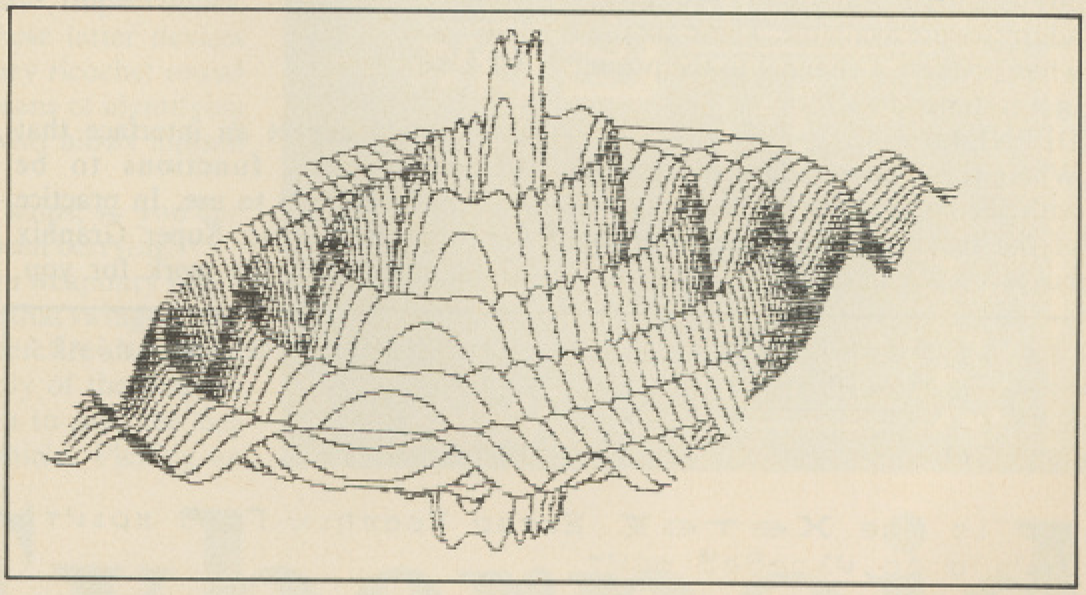
The Command Channel

The above is by no means everything that can be set up within the interface. Many other commands are sent to it through the command channel.

The command channel is accessed in exactly the same way as the one in a disk drive, using a secondary address of 15. For example the following series of commands will send a listing of the current disk directory to the printer:



All three screen dumps are produced using the printer dump



```
OPEN # 1,4,15
PRINT    1,"D$"
```

One extremely important thing to note with the above command is that one issued with the command the interface takes control of the disk drive, loads the directory into itself and prints it out. The computer takes no part in this sequence and the user can continue using it while the directory is being printed.

Since there are over 50 different commands that can be sent to the printer. Obviously I can't detail them all here, but I will list just a few:

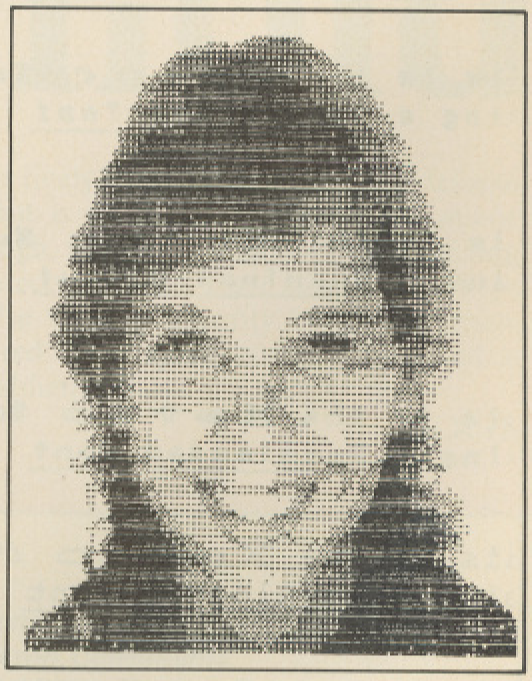
Xn – Select international character set n

F # n – Use disk drive number n for all downloads

QR – Print a Quick Reference of the different secondary addresses available

DT:xxxx – Download text file xxxx from disk and print it using secondary address 4.

DA:xxxx – Down load text file and print it using the secondary address set by using the SAn command.



DC – load in customizer file from disk. A file that contains all of the information about your setup.

DP:xxxx – Download a 40 column picture into the interfaces buffer.

DO:xxxx – Download 40 column

picture and start printing immediately.
DW:xxxx – Download 80 column picture and start printing it immediately.
Fn – Use font number n.
DNn:xxxx – Download a normal font from disk in slot number n.
DSn:xxxx – Download a super font from disk in slot number n.

Quite a collection of powerful facilities, as you can see. As previously mentioned the above is only a small selection of the various commands available.

Secondary Addresses

As you can see from th above list of commands various secondary addresses are available. These are used when opening a channel to the printer in a command such as:
OPEN1,4,n
Where n is the secondary address. As with the commands I will not list all of the secondary addresses available but just a few of them:

0 – Upper case text and graphics;
1 – Same as above with no auto-line feeds;
2 – Upper case fonts and graphics;
3 – Hex data dump;
4 – Transparent.

As you can see many of the secondary addresses have similar functions to some of the commands and switch functions.

As with normal file operations you can have more than one file open to the printer. This means that you could have both a transparent file and a text file open at the same time. Useful if you want to use the printers own commands and send text.

In Use

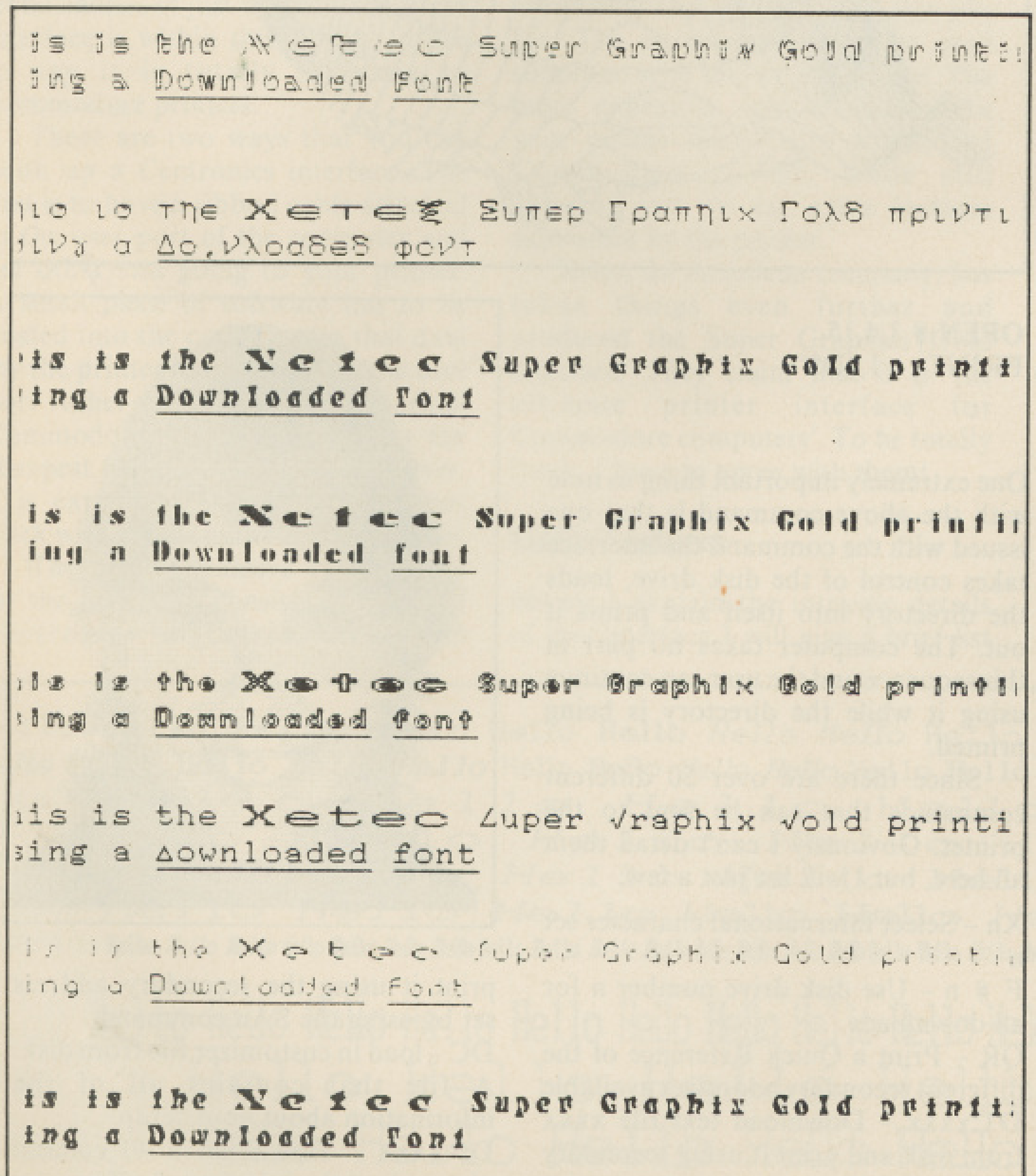
One would expect an interface that offers so many functions to be extremely difficult to use. In practice the opposite is true, Super Graphix Gold does all of the work for you. Initial setting up of the interface to meet your requirements but an excellent manual and a switch monitoring program supplied on the disk that comes with the interface makes it fairly simple.

Being able to print out in different fonts is extremely useful. Over 25 are supplied on a disk with the interface as well as programs for both the C128 and C64 that allow you to design your own. The presence of an NLQ font in ROM on the interface is great and the print quality on my Star printer is excellent. For examples of some of the fonts, see the tables with this article.

You have probably already realised that the interface allows you to perform screen dumps, though all commands detailed so far only work with screens on disk. One extremely novel feature of the interface is that it contains two screen dump programs, that's right the interface contains them NOT the disk supplied with it.

To LOAD these programs into memory you simply enter:
LOAD "LDxx",4,1 for the 40 column version and
LOAD "HDxx",4,1 for 80 columns.

The xx in the file name is used to specify where you want the screen dump program to reside in memory.



Samples of downloaded fonts

Verdict

There's so much more that I could tell you about this interface, but of course space will not allow it. As you can see the interface certainly performs more than any similar device on the market. Unfortunately, its price reflects this fact. Even so I would have no hesitation to recommend this to any one looking for a printer interface.

Super Graphix Gold is certainly the 'Rolls Royce' of Commodore printer interfaces and is a must for anyone serious about their printer.

Should you have a dot matrix printer that doesn't have NLQ fonts and you are thinking of changing your printer because of this, Super Graphix Gold will give you access to many more fonts than any of the low priced printers and is cheaper – think about it.

Touchline:
Product: *Super Graphix Gold Interface.* ***UK Supplier:*** *Bytes and Pieces, 37 Cecil Street, Lytham, Lancashire FY8 5NN.* ***Price:*** *£99.95.*

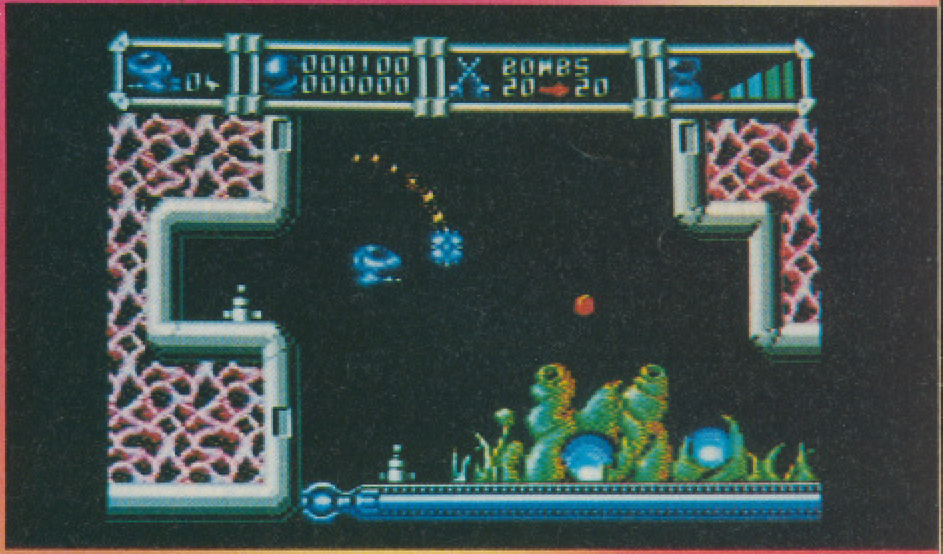
Cybernoid

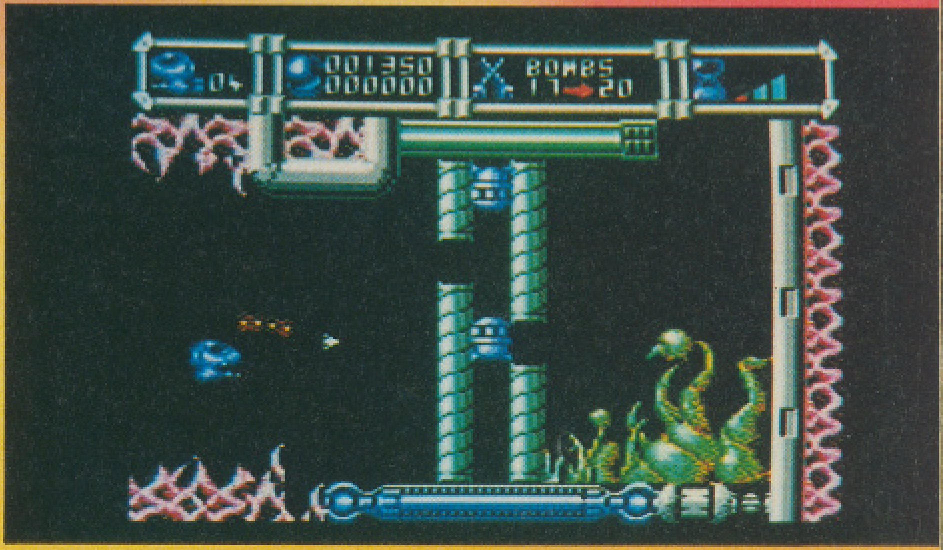
If your idea of pirates is Errol Flynn buckling his swash, Long John Silver and men walking the plank, then think again. For pirates have existed throughout the ages and now it is the turn of the Federation to be infested by intergalactic men wearing black eye patches.

The storage depot once contained jewels, minerals, ammunition and the very latest in battle technology, but repeated plundering has diminished the supplies to such an extent that serious action has got to be taken.

To that end, you have been commissioned by the Federation to destroy these latter day Henry Morgans but they must have got wind of your mission, for they have managed to activate every single defence mechanism in the depot.

Your craft, the Cybernoid is billed as The Fighting Machine and not without good reason for you have six different weapon systems at your fingertips. Your laser is effective only against the pirate ships, but you do have unlimited supplies. Apart from that, it is up to you whether to activate a few bombs, your defensive shield, Impact mines, Seeker missiles or Bouncing bombs. These latter devices are very much a two edged weapon as they ricochet round the walls of the cavern as they have no means of identifying friend from foe, and it is a poor hero who blows himself up.





As you shoot and destroy the pirate ships, so you can collect whatever booty they might have been carrying.

Some carry stolen supplies, others extra weaponry which may prove useful such as a rotating sphere that swings round the Cybernoid destroying all it touches. There are also yellow canisters which will add one to the supply of the weapon system currently selected. It is up to you to pick the one that you have fewest of – usually the shield. Picking up the treasure is easy if the bottom of a screen is solid. You just wait for gravity to do its business. But if the loot falls off the bottom of the screen, it mysteriously disappears between there and the top of the next one!

The depot is in the form of a large one way maze. One way in so much as there is only one route through it and also, there is no backtracking. Once you enter a screen, you cannot turn and run away.

The eventual objective is to make your way to a storage depot and deposit whatever goodies you have managed to recover. There is a time limit though and if you don't reach the storage area before the time limit runs out (shown by an ever increasing graph) your ship automatically self-destructs. Similarly, if you don't collect enough booty. All this seems a trifle harsh on you when you have been especially asked to come and help out, but then who said life was fair anyway.

Success in Cybernoid relies more on timing than on any great tactical strategy. Frequently the game feels more like one of the old platform classics than a shoot 'em-up as you manoeuvre yourself through some of the pipes. Control of your ship which involves countering the effects of gravity also takes some getting used to.

Graphically, the game can be traced fairly easily back to its Spectrum origins which may put some people off although the effect is a lot better than some games I could mention. There is a jolly little tune, although I suspect that most players will soon opt for the effects only.

Gameplay itself is finely balanced and there is a definite urge to find out what is on the next screen. One minor bug on my copy though, was that my number of remaining lives counter didn't decrease when I got zapped, so I kept flying on with a false sense of security before the game over message appeared. That apart though, Cybernoid is a highly enjoyable, addictive shoot 'em-up.

G.R.H.

Touchline:
Title: *Cybernoid.*
Supplier: *Hewson Consultants, 56B Milton Trading Estate, Milton, Abingdon, Oxon OX14 4RX*
Tel: *0235 832939.*
Price: *£9.99 (Ca) £14.99 (disk).*

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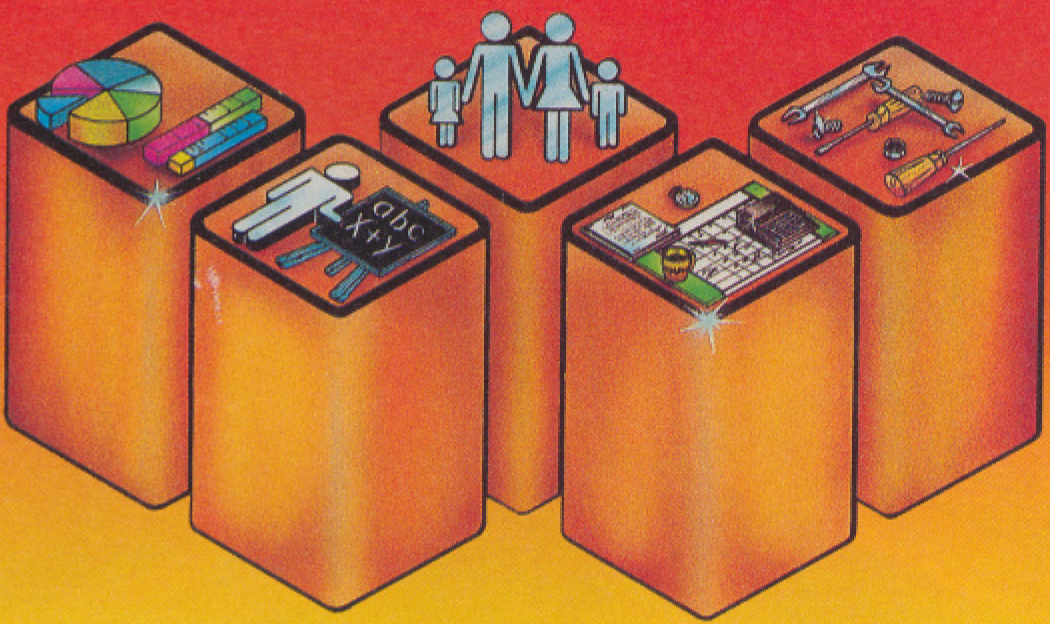
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Merlin 128 Assembler

A two pass assembler for the Commodore 128 is very welcome but is it a rare beast?

By Eric Doyle



Merlin 128 is the only assembler that I've seen for the C128. An assembler is a sophisticated program which makes machine code programming much easier, but you may wonder why one is needed for the C128 because it contains a monitor already.

The monitor is very useful for winging in the odd simple utility but when it comes to serious programming you can't beat a good assembler. The difference is that an assembler treats machine code programming in a structured way.

The problem with a monitor is that an omitted CLC command cannot easily be inserted when debugging a routine. To make space for the command, code has to be shifted and memory jumps manually, renumbered. Assemblers allow the use of labels and line numbers. This means that if a CLC command has to be added it can be done simply by adding a line where the CLC is needed.

Jump addresses are replaced by labels so if a routine within the program is used for clearing part of the screen it can be called CLRPART, or any other name that you can devise, and a jump to this routine would be JMP CLRPART. When the code is assembled the jump is automatically renumbered to point to the new location of the CLRPART routine which would have been altered by adding the CLC command. Labels are limited to 13 characters maximum length, but if a label is longer than eight characters the listing starts to look unwieldy. All characters in a label must be alphanumerical; SETUP 1 is legal but SETUP 1 would generate a BAD LABEL error.

Merlin 128 is a very powerful program. Compared to any of the C64 assemblers available, it would rate as the best laid out program so far. The secret lies in the configuration of the C128 memory and its banked memory. Merlin's own specialised disassembler/source code generator called Sourceror (sic, very sick), is stored in Bank 1, Bank 0 is where the Merlin code and the user's source code is stored.

A source code is just another name for the program listing that is currently being worked on. When the program is assembled (converted into proper machine code) the code generated is referred to as the object code.

Writing source code is as easy as using Basic as long as machine code commands are understood by the user. In addition to the usual mnemonics, the source can also contain any of the 50 special command words (pseudo opcodes) which simplify the challenge which coding presents. Pseudo opcodes cover such operations as assembling directly to disk, setting the start address of the assembled source code, saving and loading files, formatting printouts and for calling up macros.

Macros are stored on a library disk and they are often used subroutines which may be added to a source listing as it is assembled and saves the user the effort of typing in the same pieces of code time after time. The advantage of macros on Merlin is that labels can be localised so if the macro contains a label such as LOOP and this label is already used elsewhere in the program then a DUPLICATE SYMBOL error will not be generated. Macros can also use variables. If a macro is written in this way:

```
STORE MAC
      LDA )1
      STA )2
```

it can be called by STORE # $00;$FA. The value $00 would be used in the LDA command and the value would be stored in $FA.

Outer Space

All good things come to an end and the same is true of available RAM for source code storage. This space is very generous (35K) but if code runs beyond this separate files can be linked together for assembly.

The resultant source code can be up to 40K and longer programs would need to be generated through several programs stored on disk and then joined together through the C128 monitor.

The Sourceror is a wonderful addition which operates like an assembler in reverse. It takes any raw code and creates an assembly listing which can then be properly labelled using the search and replace facility within Merlin. Sourceror has its own label table which means that a code string such as $20,$D2,$FF which would normally disassemble as JSR $FFD2 would become JSR BSOUT. If you want to add your own labels, or to change any of Sourceror's, the labelling file can be tailored accordingly.

Additional Problems

The only thing I didn't like about Merlin was the way in which lines are inserted into and deleted from the source code.

All lines are numbered automatically in steps of one. To insert a line between lines 11 and 12, for example, would be achieved by typing I12 followed by RETURN. The new line is typed in (e.g. CLC) and on pressing return the whole program is renumbered. When I write a program in Basic I like to start all subroutines on a round number such as 100 or 5000 so that I can list these parts for alteration by remembering the start addresses. With Merlin this is not possible because of the auto-renumbering.

Deletion poses a linked problem. If two areas are to be deleted, e.g. 400-430 and 20-50, they must be removed in this order. If lines 20-50 are deleted first, the auto-renumber will move lines 400 to 430 further up the listing to 370-400. If you don't bear this in mind disaster could result.

I feel that this is the fault of the programmers who should have looked at the programming environment which the user would be used to; Basic. Then Merlin ought to mimic this system as far as possible to make it user friendly.

In time the user will adapt to these problems so it would be wrong to condem Merlin because of them.

The manual is a proficiently written, spiral bound booklet of around 150 pages so it is impossible to cover all of Merlin's little tricks and treats in a review. All I can say is that if I had bought this program blindly I would have been delighted when I loaded it up at home. The Merlin assembler is excellent and Sourceror adds a thick and generous layer of icing on the cake with candles! YC

Touchline:

Supplier: Roger Wagner Publishing Inc. UK Distributor: Financial Systems Software, 2nd Floor, Anbrian House, St. Mary's Street, Worcester WR1 1HA. Tel: 0905 611463.

Relative File Programming

In the last two articles of this series, Routines were explained, which would set up, create and housekeep a relative file. Now we go on to a method of using the records that have been created, and displaying them in the most efficient way

By Eric Ramsay

Whichever method of RECORD Write or Read you might have opted for, the following programming refers to those Routines by the same Line numbers so there is no confusion. I am assuming that in your program you will probably have two Menus to display options. Menu 1 would probably be something like:

Program	**Menu**
1 Create	File
2 Enter	File
3 See Director	
4 Exit Program	

Both the first two options will take you eventually to a second menu – the File Menu which might look something like this:

File	**Menu**
1 Enter	Records
2 Browse	Records
3 Search	Records
4 Print	Template
5 Change	Keyfield
6 Sort	Records
7 Sequential	List
8 Exit	Program

This is only a suggestion of course. You might have other ideas! If you have programmed correctly, you will be able to use the routines I have already given for setting up a File and Entering RECORDS into it. The following routine is a suggested Browse function, within which you will be able to scan the RECORDs, amend them, copy them or print them out.

In the next article in the series I will suggest a sort and search which will find any RECORD from a KeyFIELD in a file of 3,000 in less than 9 RECORD reads! However, that subject requires an article of its own, so you will have to wait!

The following routines work in either BASIC 2 and BASIC 3.5+, except where I show different. The first routine we need is the one which will separate the DISK$ read from the RECORD into the correct FIELDs. The routine is itself quite easy:

```
4170 rem **** read RECORDs into fields
4180 fora=0toc: disp$(a)=mid$(disk$,fpoi (a), field (a)) :nexta
4190 return
```

Here we have split the Collection String Disk$ received from the RECORD Read routine using MID$ and the FIELD Pointers Array, FPOI() into the String Array DISP$(). You will have to remember to DIMension this Array in the beginning of your program. Among the other items you might have, Line 10 should have:

```
10 dim disp$(C):rem*** where c=no of FIELDs
```

If you have elected to use the FIELD Separation method Read into the Array (which I have mentioned in part two) this has already been done, and you would enter the Display subroutine at Line 4300. Now we will look at the Display Routine:

```
4300 print "Record No:"disp;" of ";rn;
4310 for a=0toc
4340 printtab(?)a+1;tab(?);field$(a);tab(?);disp $(a)
4350 nexta:return
```

There are a few lines missing but leave these spaces because there are several functions that need to be used here that we have not reached in the series yet. The DISP Variable is the current RECORD Number used in the Browse Routine. RN is the Variable you should remember from parts one and two, being the Number

of RECORDs current in the file. I have placed a ? in the TAB Statements because I use 80 columns and those of you with BASIC 2 will need different numbers there, which is really a question of preference.

You may have noticed that at no stage have we entered any details of the FIELDnames into the RECORD. Well, of course the FIELDnames are constants and not part of the RECORD data, so including them inside the RECORD, as I saw suggested in a recent article from another magazine, is utter nonsense: including FIELDnames inside the RECORD merely wastes precious Bytes. Imagine using fifteen FIELDs with each FIELDname of 10 characters: this would use 150 Bytes of the 254 available!

Above, you can see how we display the FIELDname together with the data from the RECORD, by using the FIELD$ Array beside the DISP$.

Browse Routine

I have used a Secondary Browse Menu on the Display RECORD screen, from which a single Keypress can command the Display to change. You might wish to do it differently. First we OPEN the File, BASIC 3.5+

```
2680 dopen#5,(name$), d0, u8:
gosub3610
```

Or BASIC 2: (Command Channel already opened)

```
2680 open 5,8,5,name$:gosub3610
```

Then the screen is cleared:

```
2690 scnclr
```

Now we declare to Variables; the BEGinning RECORD number to browse, and the FINish number. We set the BEGinning to 1, naturally, and the FINishing to the RECORDs used counter RN. This ensures that the program does not ask for a non-existant RECORD Number.

```
2700 print "Browse";
2710 gosub 4210
```

I use the same Limit Routine from several different parts of the program, so I usually GOSUB to this Routine. This enables the user to select the RECORD Numbers he wishes to Browse between, as well as List and various other functions. Here is the Limit Routine:

```
4200 rem **** limit Routine
*********
4210 beg=1:fin=rn:print "within Limits
(y/n)?"
4220 getkeyyy$:ifyy$="n" then
disp=beg: return
4230 print "Begin at Record No": input
n$:n=val(n$)
4240 beg=n:disp=beg
4250 print "End at Record No":
input$:n=val (n$)
4260 if n < beg orn > rn then fin=rn:else
fin=n
4270 return
```

This routine makes several checks before it continues. It ensures that the beginning is 1 and the finish is the last RECORD Number. Then if the user wishes to begin at a higher number than 1, Line 4240 declares that and sets the DISPlay Variable to the new BEGinning number. Then the FINish Variable is INPUTted, and a check is made in Line 4260 that the FINish number is neither less than the BEGinning number nor greater than the RECORD existing on the File.

If either is the case then FIN is set to the last RECORD number, RN, otherwise FIN is the requested Last RECORD number in the Browse. The program then RETURNs to the Browse Routine.

I window the following Browse Menu on my 80 column screen, but you may have your own preference, depending on your screen size. The Menu shows:

```
2720:          rem display menu
2730 print"Search Goto First Last
Next Back Edit
Copy Print Delete Menu
2740 rrec=disp rem **** get RECORD
number
2740 rem for BASIC 2 rp=disp:gosub
4114
2750 gosub 4120: rem **** read
RECORD from disk
2760 gosub 4280: rem*** display
RECORD
2770:
2780 getkeyaa$:aa=instr ("sgflnbec-
pdm", aa$):ifaa < 1then2780
```

You should be able to follow that. The Routines are all there to do the job. BASIC 2 users, of course, do not have the INSTR function which makes a search of a String within another. You can do the same thing this way:

```
2780 getaa$:ifaa$="" then 2780
2780 fors=1to11
2782 ifaa$=mid$("sgflnbecpdm",s, 1)
then aa=s:s=11: go to 2790
2784 next s
```

Having selected the Routine from the first letter of the function from the Browse Menu, the program then branches to the appropriate Routine:

```
2790 on aa goto 3030,2900,2800,
2810,2820, 2830, 2940,3140,3200,
3290,2840
```

The remainder of this Routine is quite straightforward. The DISP Variable is altered according to the different Routines which processes it:

```
2800 disp=beg:goto 2740: rem **** go
to first RECORD
2810 disp=fin:goto 2740: rem **** go
to last RECORD
2820 disp=disp+1:goto 2860:rem ****
next RECORD
2830 disp=disp-1:goto 2860:rem ****
previous
2840 dclose:REMplace update counter
here to save h'keeping
2850 goto290: rem **** return to menu
2
```

Here I have caused the Display to 'wrap around' if a 'Next' is requested at the end of the file or a 'Previous' is requested at the start of the file then the DISP Variable is altered to the start or end number:

```
2860 if disp<fin then disp=beg: rem
**** wrap around
2870 ifdisp<beg then disp=fin:rem
**** effect with display
```

Now the RECORD Number processing is finished and the Line 2880 returns the Routine to display the next RECORD:

```
2880 goto2740
```

Now I can outline some other Routines also used by the Browse Menu. As I mentioned before, the Search Routine must wait for its own article, as must the Delete Routines, but the above Routine has only covered the first, last, next, back and menu options on the file menu: there is still copy, amend and print routines to come. They follow the end of the Display Routines. The first is the 'Goto' Routine:

```
2890 rem **** additional display
routines
2900 print "Enter Record No to
'Goto' "
2910 getkey n$:n=val (n$$):if n<beg
or n>fin
```

then print "File Limit Exceeded:":goto2910

BASIC 2 owners do not forget to change the Getkey command in Line 2910.

```
2920 disp=n:goto2740
```

Next is the RECORD Edit or Amend Routine. It is a good idea to have an Edit Counter to turn on if this option is used which would direct a save of the Housekeeping on exit from the program. I used a poke to a specific location in RAM, but a Variable would do just as well: xx will do.

Incidentally, with the number of times that the program requests INPUT from the keyboard, you might consider a separate INPUT Routine to which you could GOSUB whenever you need the keyboard. The one I used I shall give you now to save me re-typing the Getkey over and over. Yes, BASIC 2, I shall write one for you as well. Here it is:

```
3420 rem **** number input routine
3430 open 1,0:input # 1,n$:close1:
n =val (n$)
3440 if n   1 then 3430
3450 return
```

As you can see, a file is OPENed to the keyboard so that horrible ? is avoided. Numerical data is accepted into the String N$ and VALued in the Variable N to prevent a program error in the event of some idiot pressing a non-numeric key. Line 3440 checks for that and then 3450 RETURNs the Routine. Now to continue with the rest of Routines:

```
2930 rem **** edit mode Routine
**********
2940 xx=1:printer "Enter FIELD No
to Edit?"
```

Get Fieldnumber to Edit:

```
2950 gosub3430:n=n-1:ifn < 0 or n > c
then 2940
```

Re-write the FIELD contained in Disp$(n)

```
2960 input fs$:disp$(n)=left$
(fs$+pad$,field (n))
2965 scnclr:gosub 4300
2970 print"Edit Another FIELD ? (y/
n)":getkey yy$
2980 ifyy$="y"then 2940
```

Re-collect the String DISK$ with the new Field:

```
2990 disk$="":for a=0toc:disk$
=disk$+fs$:nexta
```

Declare the RECORD Number and GOSUB to the Write RECORD Routine:

```
3000 wrec=disp:gosub 4070
3000 (for BASIC 2 – rp=disp:gosub
4114:gosub4070
```

Then go back to the beginning of the Display Routine:

```
3010 goto 2740
```

If you have chosen the FIELD Separated method then you must add a CHR$(13) to the Collection String, Line 2990:

```
2990 disk$="":fora=0toc:disk$=disk$
+fs$+chr$(13): nexta
```

but otherwise the Routine is exactly the same. BASIC 2 users do not forget the change in Line 3000.

Copy Routine

It is useful to have a facility to copy an existing RECORD into a new one, to alter it to make a unique one. If you need several RECORDs which are almost identical then you need to write just one then copy it several times and make the changes to the new ones. This can save some typing! Since we are making a New RECORD, we increment the RECORD counter, RN, and declare the Write RECORD Variable WREC as the RECORD number to write to, naturally since the new RECORD is to be created at the end of the File:

```
3130 rem ***** Copy Routine
**********
3140 xx=1:rn=rn+1:wrec=rn
3140 (for BASIC 2)
xx=1:rn=rn+1:rp=rn
```

It's as simple as that, except for BASIC 2 owners who will have to make a minor change. We have already Read the RECORD and have the DISK$ all ready in Variable memory. Even the Fields Separated method users have the DISP$ Array, but they have to add a Line:

```
3145 disk$="":fora=0toc:disk$=
disk$+disp$(a)+chr$(13)
```

...because they have not used the Read in one or three method. Now all users have the Collect String ready we can continue. We simply write the RECORD with:

```
3160 gosub4070:rem *** write copied
RECORD
```

However, a little more work needs to be done. We are still in the Browse mode, and the program will be confused by this sudden appearance of a new number. So we reset the DISPlay and the FINish Variables and then we can return to the beginning of the Display Routine. The new RECORD will now be read again from the File and displayed:

```
3170 disp=rn:fin=fin+1
3180 goto 2740
```

Hardcopy Routine

If you have a printer it is always useful to be able to press a key and receive a hardcopy of a RECORD. This is the Print routine. If you have programmed for a Printer before it should be easy to follow:

```
3190 rem **** single printout Routine
******
```

Notice the Secondary Address 7 in the Printer OPEN Line. This is to print in Lower Case, since I assume you will want this. If not, omit the '7', on the end of the OPEN 4,4,7.

```
3200 open 4,4,7:print # 4:print # 4
3210 print # 4,"Record Number";disp
;" of rn ";
3220 print # 4:fora=0 to c
3230:
3240:  print # 4,a+1
3250  print # 4," ";field$(a);
3260  print # 4" ";disp$(a)
3270 nexta:close4:goto 2760
```

Do not omit the ';' semi-colons. They are easy to miss, but they suppress the carriage return to the printer and without them the entire printout will run down the page instead of across in neat lines. You may wish to add additional facilities to the printout to your own preferences, such as reversed-FIELDnames, etc.

Although this article is much shorter than previous ones, I have dealt with all but two of the display routines. The next article is somewhat more complex and a fascinating challenge to Relative programmers: Sorting and Searching on the KeyFIELD. See you then! YC

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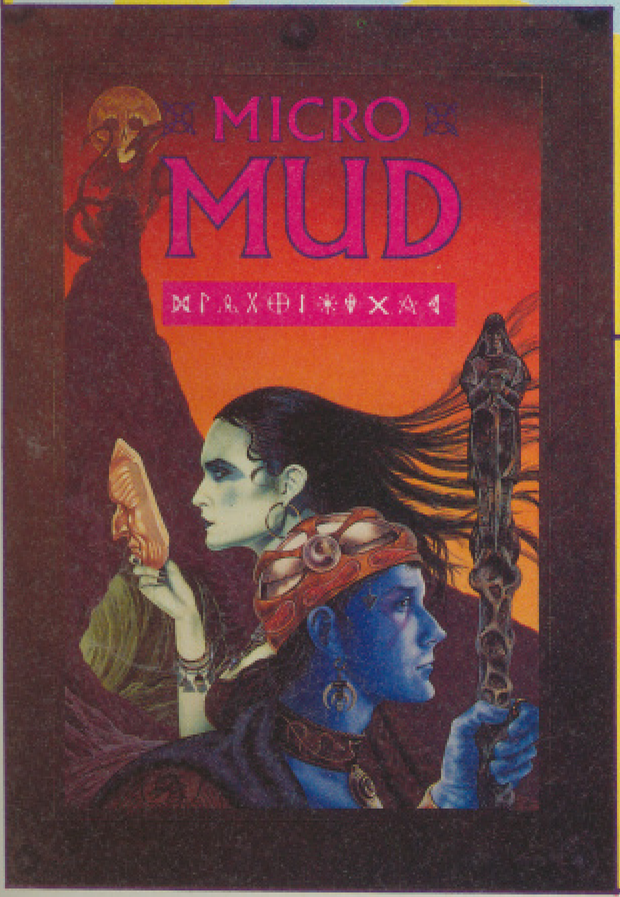
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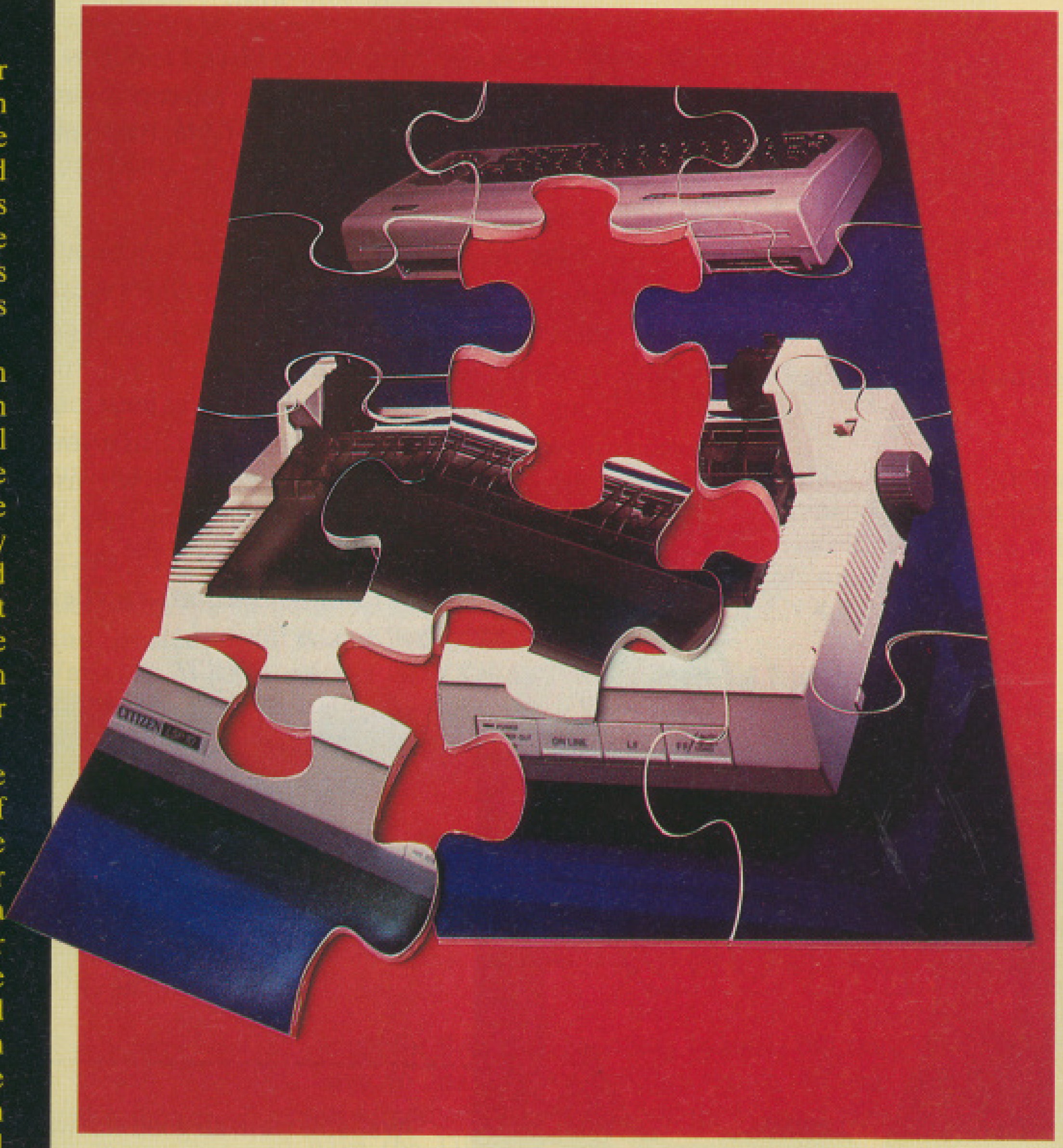
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Printer Principles



Escaping from Commodore branded printers requires extra knowledge of printer compatibility

By Eric Doyle

Avoiding the worries of leaving the Commodore coral of printers can mean trading away the added power of a wider range of facilities for convenience. You don't have to be a technological whizz to be a bit more adventurous, but a little background knowledge helps to avoid the pitfalls which gape for the unwary.

For most people, a printer means a dot matrix model. This type gives a wide range of possibilities beyond normal typewritten characters. A good printer will allow user definition of characters and high resolution image printouts.

Any Storm in a Port?

The standard Commodore printer communication is performed through the serial port. This is probably the slowest way of shunting data around and most other computer systems favour parallel printing systems. The difference between the two methods lies in the way in which the data is formatted for transfer.

Imagine a small factory with conveyor belts transferring items from one place to another. A serial communication factory would have just one conveyor belt carrying a single item of data (a bit). In a parallel factory eight synchronised belts would be used to carry each bit of a byte to the output at the same time (i.e. in parallel). The net effect is that the parallel system is approximately eight times faster than serial.

For Commodore owners the choice is limited to the serial system but if a parallel printer is chosen, there are two optional ways in which the printer can be connected. One is to use a parallel cable to connect the printer directly to the user port. The alternative is to connect to the serial port through a suitable interface which recombines the bits into a parallel byte suitable for the printer input. Both systems have their strengths and weaknesses.

The user port parallel connector needs special software to send the information in a format which the printer understands. This means a loss of memory space in which the driver is stored. The obvious problem is that some software will not allow such a system to run alongside itself and the printer can be rendered inaccessible. Fortunately, many of the better packages contain their own drivers but

when these are not in use, the user has the hassle of loading their own special program which, as we shall see, can be relatively lengthy.

Life is simpler with a serial port interface though the benefit of fast data transfer is sacrificed for this ease of use. Within the interface is all of the necessary software and hardware to convert the serial signal into parallel.

Code Crossover

In their infinite wisdom and because of their desire to maximise on the graphics capabilities of their computers, Commodore devised a special version of ASCII codes way back in the PET days. ASCII a standardised system for data transfer between machines so, by messing around with their own system, Commodore have complicated communications through the need for PETSCII to ASCII converter.

Nearly all printers use ASCII so the software for a user port link-up must have a conversion table, more memory eaten up. Once again the serial interface wins out because the job can be done outside the computer. Not only can an interface convert to ASCII but it can normally be switched to pass data without interference in transparent mode. This is useful when all of the necessary conversions are made through application software running on the computer.

Another benefit of using an interface is that the transparent switch is often accompanied by other switches some of which duplicate the functions of some of the internal switches inside the printer. If you're now asking how switch duplication is beneficial, you've obviously had limited experience of printers and the fiendish methods that the manufacturers employ to make these wretched facilties virtually inaccessible.

Three or more switches enable matching to the most common manufacturers makes, but other switches can add extra linefeeds, change the device number to either four or five and often there is a hex dump mode. The final mode is especially useful when printer communication gives unexpected results. Instead of using the codes as commands, the interface converts every piece of data into hexadecimal numbers so that the sequences can be seen and analysed for debugging.

Boot up the RS-232

Until now the assumption has been that the printer is of the Centronics type. The user port is also referred to as the RS-232 port and RS-232 means modem links, doesn't it? Not really, RS-232 is yet another standard for communication between devices and some printers, though few in number, still adhere to this system.

The name RS-232 applied to the user port is a bit of a misnoma because the true convention is to use a D-type connector with a computer originated voltage line of -12V to 12V. The user port is a simple edge connector with a supply voltage of 0 to 5V. Why Commodore insists on veering away from the accepted specifications for data interchange can only be seen as a marketing ploy to encourage sales of their own branded peripherals.

Several companies now supply RS-232 converters which plug into either the user or the cartridge ports and perform the necessary conversion of the voltage range and terminate in a suitable D-type plug or socket.

Connecting an RS-232 printer poses the same software problems created by Centronics cable connection. Special drivers must be stored in RAM and commercial software must cater for RS-232 outputs.

Each method of connection has its advantages and disadvantages. Centronics cables are by far the cheapest method of connection but inhibited by the need for driver software. At around £30, the RS-232 interface is quite expensive, requires driver software but has the advantage that it can be used both as a printer or modem interface. Since it is never essential to have both a modem and a printer connected at the same time, the dual facility can be used to stretch a limited budget because a good second-hand RS-232 printer frequently costs less than an equivalent Centronics machine.

My own choice would be a reliable Centronics interface. These start upwards of £40, but the facilities that they offer are far more extensive, more convenient and use none of the precious computer RAM. Although I have made mention of the slower data transfer speeds, these don't really affect a printer greatly unless a data buffer is used – printer mechanisms are often slow enough to mask the serial speeds.

About Face

One of the greatest benefits that a Centronics interface can offer is a range of extra typefaces to supplement the range within the printer itself. Not all interfaces offer this facility, but it's worth hunting one down if quality or presentation is important to you.

On the other hand, it may by that high resolution screendumps are important. The problem is that colours cannot easily be represented on a printer. Some interfaces provide this facility and may even offer the option for full page sized dumps or smaller quarter page printouts.

The availability of both of these functions only applies to printers with user definable character capabilities, but these days few do not offer this. Designing your own characters requires complex commands and ingenuity so why tax your brain when someone else has already done it for you!

Another desirable feature is a printer buffer. These can be part of an interface or printer, or high capacity buffers can be bought as separate units. If you use your printer heavily for wordprocessing or database and spreadsheet printouts, a buffer can be worth its weight in gold for the time savings offered.

Software hangs up while printing takes place and the shorter the time that a printout takes, the sooner you can get back to productive use of a printer. I've just mentioned that printers convert data to the printer form much more slowly than the data is passed from the computer, so a buffer acts as a kind of external RAM store.

With a buffer in use the data is thrown out of the computer at a high rate and the buffer fills up with characters waiting for the printer to get round to using it. If a document occupies 3Kb of memory, a 3K buffer will fill up almost instantaneously and fool the computer into thinking that the printer has finished. When control is handed back to the user, the next document can be written, loaded or otherwise processed without interfacing with the printer clacking its way through the buffer contents at its own pace. This often saves several minutes and negates the need to amuse yourself by beverage brewing, contemplating the nature and source of naval fluff, or looking for brush hairs in the paintwork!

Printing by Numbers

Printers fall into three main categories: Commodore types, Epson compatibles and those which fit neither of these descriptions! The best facilities are always those of the Epson compatibles, principally Epson, Star and Citizen. Precision Software also have an Epson style printer with a novel multipole head system for high speed printouts.

All software will drive an Epson-style printer and the facilities offered are always streets ahead of any Commodore machine.

Access to these special facilities such as near letter quality printing, various styles and sizes of print face and page formatting commands is achieved by special codes. To a printer all data is just a series of numbers but one number is special – 27. If this value is received the printers operating system will not print out this or any numbers which follow according to a fixed set of parameters. For example, a character string which takes the form of CHR$(27) followed by CHR$(70) will set the printer into emphasised print mode. Any numbers following this command will be printed out as an emphasised form of their ASCII equivalent until another CHR$(27) command is met.

Without an interface some character values such as CHR$(18) which would set a Commodore printer into reverse character mode (RVS ON) won't affect Epson printer in the same way. CHR$(18) on an Epson is the character used to cancel condensed printing mode, and this is one of the reasons why an interface is essential.

Many makes of printer now come with an optional Commodore interface built into them which makes them an excellent choice. Extra typefaces and print modes can be readily accessed and compatibility is guaranteed.

All is not lost with Commodore printers; the 801 has many of the essential features of an Epson compatible but often the quality of the letters produced is inferior. Two companies currently produce replacement chips which will extend and improve the range of typefaces available and this could be a worthwhile upgrade for owners of these machines.

Dodging the Dots

Non-matrix printers include daisywheels, ink-jet and laser machines. All are more expensive than dot matrix machines and pose special problems.

Daisywheel printers produce excellent quality printouts and various typefaces can be added by swapping wheels of different types. The drawbacks with a daisywheel is that printing is much slower and graphics dumps are impossible. The advantage is that an interface does not have to be very sophisticated, so a cheap Centronics unit stripped of all the graphics bells and whistles can be used.

Ink-jet printers, include limited colour capabilities and laser printers offer high quality printouts which are virtually indistinguishable from a typeset magazine page. The bad news is that the necessary drivers for these machines have not filtered down to Commodore level and software is non-existant.

One type of printer which I've not mentioned is the plotter. Commodore used to produce an inexpensive four-colour plotter, VIC 1520, but I haven't seen any around the shops during the past year. These were excellent little machines which produced quite a high quality printout but the pens could dry out very quickly and the maximum paper width was only six inches.

If you need a plotter the Toshiba HX-P570 is an excellent choice. Although this machine was designed for use with MSX computers I have found that it works adequately through a Centronics interface. The big advantage of the Toshiba is that it can take A4 sized paper but the pens are the same as the ones used by the 1520.

To help you choose the printer set up that suits your needs, there is a useful address list at the end of this article for prices and products so you can contact the companies direct.

Printers

Citizen Europe Ltd: Wellington House, 4-10 Cowley Road, Uxbridge, Middlesex UB8 2XN.

Commodore Business Machines: Commodore House, Gardner Road, Maidenhead, Berkshire SL6 7XA.

Epson: Dorland House, 488 High Road, Wembley HA9 6UH.

Precision Software: 6 Park Terrace, Worcester Park, Surrey KT4 7JZ.

Star Micronics: Craven House, 40 Uxbridge Road, Ealing, London W5 2BS.

Centronics Cables

Datel Electronics: Units 8/9, Dewsbury Road, Fenton Industrial Estate, Fenton, Stoke-on-Trent.

Dimension Computers: 27/29 High Street, Leicester LE1 4FP.

Microsnips: 37 Seaview Road, Wallasey, Merseyside L45 4QN.

H&P Computers: 9 Hornbeam Walk, Witham, Essex CM8 2SZ.

York Electronic Research: The Fishergate Centre, 4 Fishergate, York YO1 4AB.

Centronics Interfaces

Datel Electronics: (See above).

Delta Pi Software: 8 Ruswarp Lane, Whitby, N. Yorks YO2 1ND.

Evesham Micros: 63 Bridge Street, Evesham, Worcs WR11 4SF.

Precision Software: (See above)

Stack Computer Products: Meedmore Ltd, 28 Farriers Way, Netherton, Merseyside L30 4XL.

MPS 803 Upgrades

Avon Printer Technology: Swindon House, 4 Howard Road, Southville, Bristol BS3 1QH.

RS232 Interfaces

Brain Boxes: Unit 36, Wavertree Technology Park, Wavertree Boulevard South, Liverpool L7 9PF.

Delta Pi Software: (See above).

York Electronic Research: (See above).

See listings on page 74

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First Steps

Learn how to chat up your peripherals without fear of prejudice

By Norman Doyle

The term peripherals covers anything which is not inside the computer. Obviously any disk drives, cassette recorders and printers and modems are all peripherals but the keyboard and monitor, or TV screen, are also classed as peripherals.

So that the computer knows what to communicate with, each peripheral is given a number which defines its address in Peripheral Street. Just as in Downing Street where number 10 is always the Prime Minister and number 11 is the Chancellor, some of the addresses on Peripheral Street are reserved for particular occupations. Number 10 Downing Street is currently occupied by Margaret Thatcher but it could equally have been Neil Kinnock – the maker's name doesn't matter but the job's the same. Addressing a communique to 10 Downing Street will mean that the Prime Minister will receive it for processing, whoever that person may be.

Similarly, number 1 Peripheral Street is always occupied by the cassette recorder which may or may not be called a Commodore but which will be a load and save device which uses a tape. Number two is a modem or RS-232 device, number three is the screen, number four and five are each reserved for a printer and 8 to 11 reserves space for other storage/retrieval systems such as disk drives, hard disks, wafer drives or anything else that may have been dreamed up.

The keyboard occupies a special address. In Commodoreland streets are numbered from zero upwards so the keyboard resides at number 0.

From switching on the power, several hotlines are set up which directly communicate with specific addresses. The keyboard is where the CPU (the 6510 chip) gets its information directly from the user, the screen is set as the output device and the program storage/retrieval system is set to address number 1, the cassette recorder.

These are called the default settings, that is the normal heirarchy for communication. If another device is to be addressed it can be achieved in one of two ways depending on the channel.

Disk drives are selected for a single operation by tagging a ',8' (or 8,1) to the end of the equivalent cassette command. When the function is complete, control lines for input and output are passed back to the screen and the keyboard. If you want to test the verity of this form of command, try saving a program with ,4,1 when a printer is attached. You'll get a response but nothing particularly meaningful.

Some devices behave better when

treated as a file saving store. This is true of the printer and a file must be opened and printed too but no file name is necessary. You could use OPEN 4,4,7, "progname,S,W" and then PRINT # commands but the result would just print the string (the characters in quotes) before printing out the PRINT # statements.

The convention is that OPEN 3,4 is used. The leading 3 is an arbitrary value which denotes which of the computers 256 communication lines will be used and could therefore be any number from one to 255. The significant digit is the second 4 which means 'talk to the printer'. Sometimes this command is supplemented in the form OPEN 4,4, x where x is a secondary command which sets the printer or interface into a specific mode such as lower case character enable.

After opening the file one of two commands can be issued. PRINT 3 will print whatever follows it directly to the printer assuming that the OPEN command is OPEN 3,4. If this command has been OPEN 4,4 the corresponding command would be PRINT 4.

The second form of command is CMD3. This is used primarily to execute a LIST command so that programs can be listed out in the correct form.

```
OPEN4,4:CMD4:LIST
```

To redirect the CPU to its default devices either of the above commands should be terminated by closing the file before anything else is done using CLOSE3.

When talking to the disk drive the same rules apply but the OPEN command uses OPEN channel (0-255),8. Care should be taken because a secondary command of 15 serves a special function. This is the command mode and the specialist orders such as format, rename and scratch are sent to any channel opened in this way:

```
OPEN 1,8,15
```

Then a PRINT # command will have to follow one of the specified syntaxes for a command otherwise an error will be generated. Using a secondary command of 15 is like saying to the drive 'let's use your special Basic language'.

So files are opened using the following syntax, bearing in mind the type of device which is being addressed:

```
OPEN channel,device number, secondary address, "command"
```

For fun try these tests:

```
OPEN2,3:PRINT#3,"HELLO WORLD":CLOSE2
```

Now load a program and then type in:

```
OPEN2,3:CMD3:LIST
```

After the cursor reappears type and enter CLOSE2.

As you can see all peripherals are broadly the same and the screen is a good way to practice some of the file commands. There's nothing to fear because they're all just small variations on a single theme. YC

DIY Interface

Short of the pennies this month but need an interface – why not do-it-yourself?

By Paul Williams



This program should work with any printer with a Centronics (i.e. parallel) interface. The software listed enables you to pretend that your printer is a real Commodore printer connected to the serial bus. Of course Commodore graphics symbols won't be reproduced, but the system is fine for program listings in BASIC and assembly language (such as from the Commodore disk-based assembler package) and for wordprocessing.

The interface consists of just one piece of 10-way ribbon cable connected between the C64's user port and the printer parallel interface. Anyone with minimal soldering experience could make up this lead. Suitable connectors are available by mail order from companies such as Maplin Electronic Supplies Ltd. For my printer I needed a 25-way D-type connector. What you need to do is dig out where the connections for DATA0 to DATA6 (7 bits), DATA STROBE, BUSY and GROUND are from your printer manual, and then wire up the connecting cable in the following way:

C64 user port pin (bottom row)		Printer (as an example)	For Oki Microline pin no. (as an example)
N	(GND)	GROUND	14
M	(PA2)	BUSY	11
L	(PB7)	DATA6 (most signif)	8
K	(PB6)	DATA5	7
J	(PB5)	DATA4	6
H	(PB4)	DATA3	5
F	(PB3)	DATA2	4
E	(PB2)	DATA1	3
D	(PB1)	DATA0	2
C	(PB0)	STROBE (active low)	1

The user port connections are all on the bottom edge – pin N is the right-hand end looking from the back of the C64. All the above connections are to adjacent pins.

The driver software is a small block of machine code occupying memory locations $CB00-SCBCF (hex). Once installed it is transparent to the user (provided your program doesn't over-write it – which it is unlikely to do because this is about the safest area of memory in my experience).

Once loaded, SYS 51968 sets the software going.

To print on to the printer, do
OPEN 4,4
PRINT # 4. "whatever you want to print"
CLOSE4
in a program, or in direct mode.
To list a BASIC program, type
OPEN4,4:CMD4:LIST
then
PRINT # 4:CLOSE:4
when it has finished.

To output Commodore format assembly listings to the printer, just answer 'Y' to the relevant question when the assembler is run, after having enabled the printer software with SYS 51968.

You can leave the printer software resident as long as you like – it will only be used when you have a printer file open. However, if you want to totally deactivate the routine type SYS 51971.

Various options are available when the print routine is activated.

When initialised with SYS 51968, the system is configured for a 66 line page, printing 60 lines and leaving six blank automatically. All control characters are ignored, except for RETURN. There is no left margin indentation after each RETURN, and the system reckons it's at the top of a page. This can be changed:

POKE 52223,225 says don't ignore control characters – useful for setting printer to funny mode.

POKE 52223,0 says revert to ignoring control characters (default). Use this mode for listings.

POKE 52222,x (default value 0) sets an indentation of x chrs at the beginning of each line – useful when printing listings to be ring-bound etc.

POKE 52221,x (default value 60) sets number of printing lines per page, plus 6 blank lines. If you don't want paging, do POKE 52221,0. Do this when listing assembly language with the Commodore disk assembler, as it does its own paging.

?PEEK(52220) gives the current line number on the printing page – do POKE 52220,1 to tell the system you are at the top of a page.

The program is listed as a BASIC loader, containing checksums to point out typing errors. Type this in, save it, run it, and if there are no errors you can enable the printer driver with SYS 51968, as described before.

To sum up, if all you require out of a printer is program listing capability and straight text output, this is a cheap way of doing it if you have access to a parallel printer. YC

See listings on page 74.

Cassette Inlay Printer

How many cassettes must other Commodore users have? Lots methinks! So I have come up with a program to neaten up cassette collections which can also be used to tidy up your normal audio cassettes

By Mick Walpole



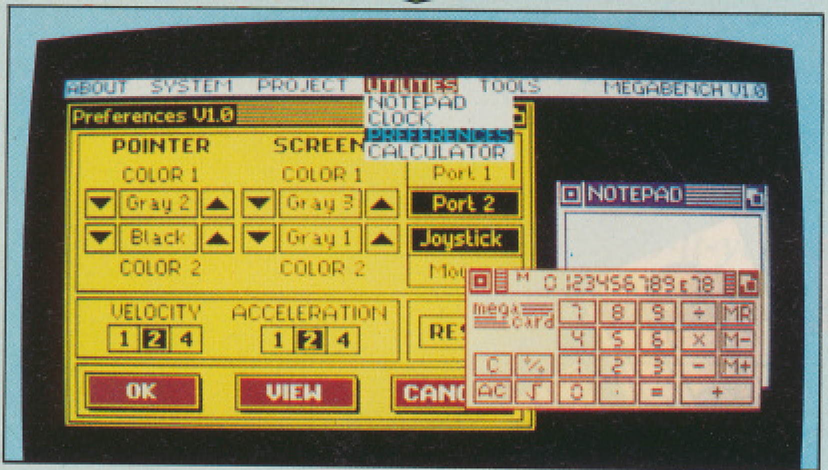
Initially, you will be greeted with the program title, a representation of the insert card and the menu. Now select the cassette you wish to create and insert for, and follow the steps below:

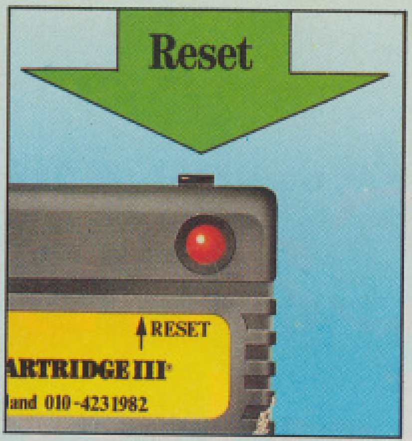
- Option 1 – the screen will clear, reprint the insert mimic, highlight the area being worked on in BLACK and request the cassette number. (This should be a number between 1 and 99). When Return is pressed the menu will be displayed again.
- Option 2 – the screen will clear, reprint the insert mimic, highlight the area being worked on in BLACK and request the cassette name. (This should be a string of no more than 23 characters in length, there is an error trap here.) When the Return is depressed the menu will be displayed again.
- Option 3 – the screen will clear, reprint the insert mimic, highlight the area being worked on in BLACK and request the details for Side A. (Up to 24 characters.) When the Return key is pressed you will be asked for the second input, and so on up to the maximum of 9 after which the menu will be displayed again.
- Option 4 – repeat the third step for Side B.
- Option 5 – you will be asked if you have entered all detail required. Switch on printer and if all is OK press Y. The printer will now print out the insert card and return to the menu ready for the next cassette.

All you need to do now is cut it out and fold it. NB. Because of the use of graphics characters and double size characters this program will only work on Commodore printers. But with a little modification, should work on any dot matrix printer. YC

See listings on page 74.

KEEP IT SIMPLE!









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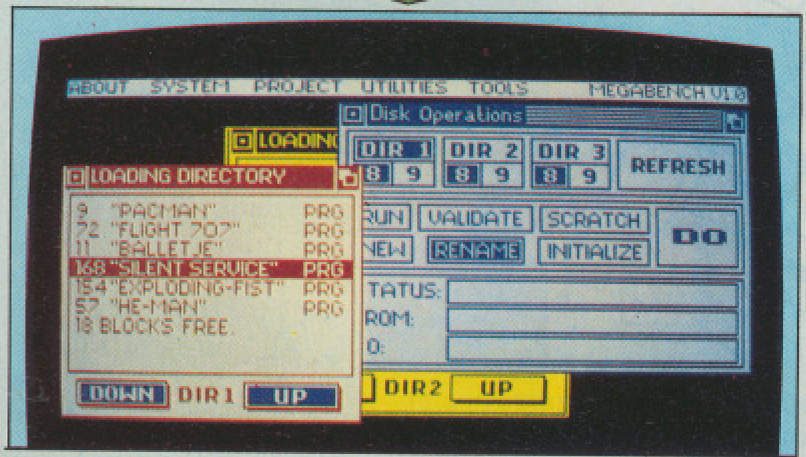
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NOTE PAD
Easy to use wordprocessor with proportional characters enables you to store and print small notes, letters, etc.

DIRECTORY WINDOWS
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DISK WINDOWS
Load, Run, Rename, Validate, Scratch, Initialize, Fast format disks.

TAPE WINDOW
Activates fast and normal modes.

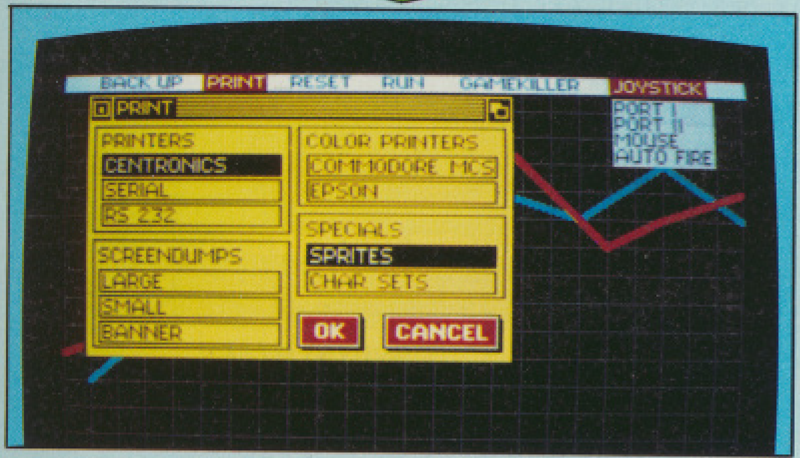
PRINTER WINDOWS
Select different printers, such as Commodore serial, Centronics, RS 232, Colour printers.

REQUESTER WINDOWS

DISC BASED USER WINDOWS

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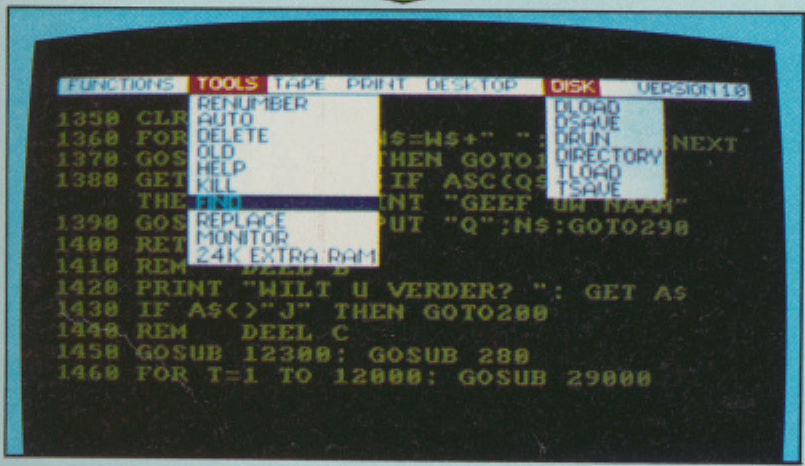
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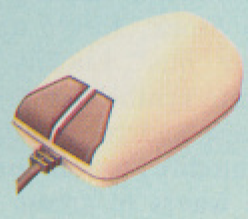
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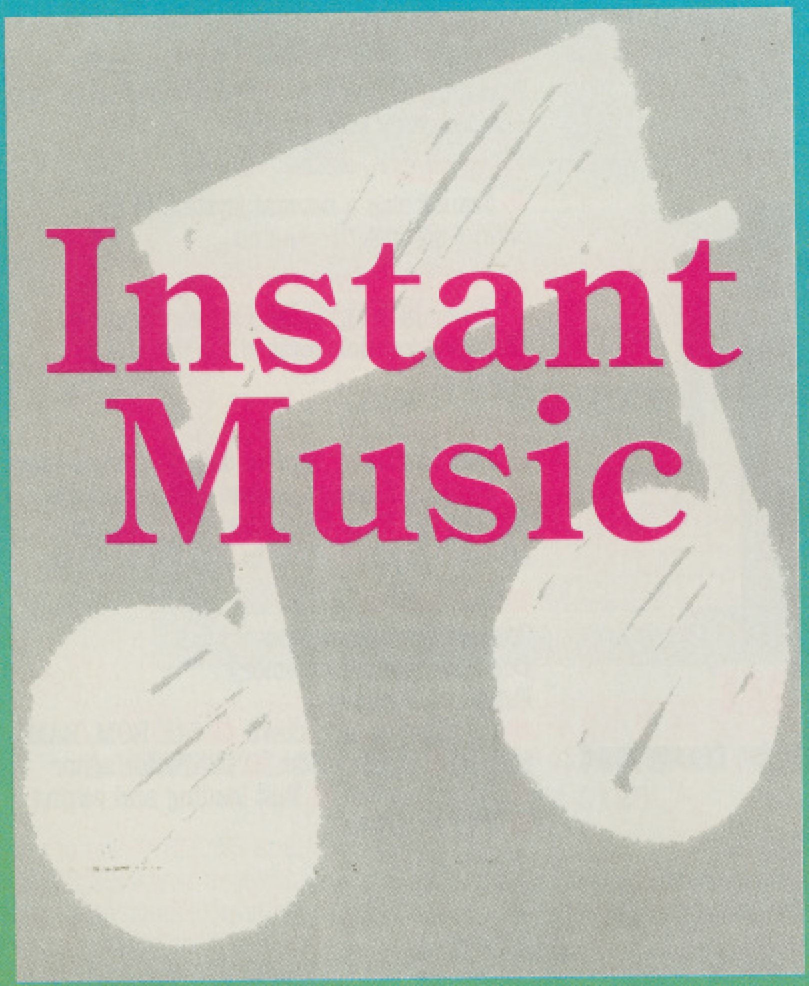
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Instant Music

Have you ever wanted to jam along to your favourite tune or remix an old classic to up the tempo or add in some new instruments? If so, then load in Instant Music, grab a joystick and get composing.

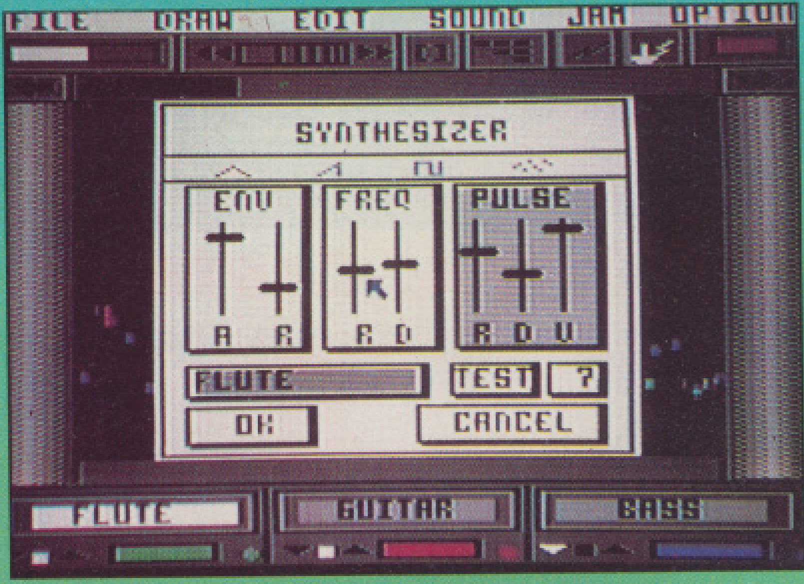
Your sheet of electronic music is the long awaited C64 version of Instant Music from Electronic Arts which had its first audition on the Amiga a few years ago. Now C64 owners armed with a disk drive, joystick and a sense of adventure can create either beautiful music or a hideous racket depending on their ability.

Instant Music provides an easy to use, joystick controlled, pull down menu set of options through which you can load in one of the 86 set pieces supplied on disk, play it and then edit it until it's a new masterpiece that can be saved to amaze your public. Some of my compositions are quite amazing particularly the double tempo remix of Greensleeves featuring a synthesiser, guitar and a flute!

Once you have a tune in memory you can have great fun editing it either by copying sections to make it longer, if not repetitive, or you can change the tempo to make it faster or slower or swap one of the three instruments for another, selected from a pull down menu. Most of the twelve instruments supplied with the program do sound quite reasonable given the tinny quality of C64 music. This can of course be improved by playing Instant Music through a MIDI system but I doubt my creations warrant the extra expense. However the drum sound is awful and sounds more like someone clearing his throat. In fact I doubt even if Messers Stock, Aitkin and Waterman would use it on one of their "hits". Luckily, all is not lost as you can load in a separate synthesiser program through which you can adjust attack and release times, the rate, depth and ratio of pulses, modify modulations and add in triangle, sawtooth and pulse waves to create the sound that you've always been looking for.

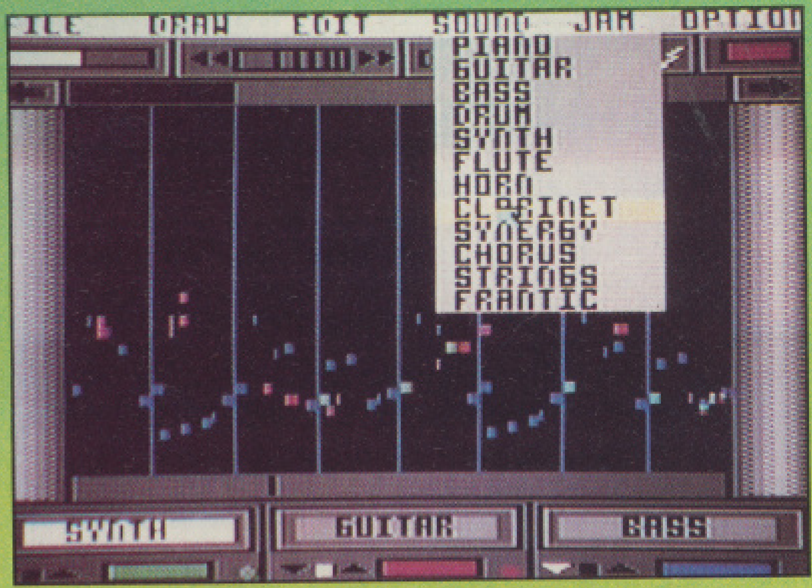
Instant Musicians will find many uses for such a program ranging from demonstrations to answer the old "what can you do with a computer" questions through fun jamming sessions to trying out new phrases before inflicting them on your musical colleagues.

Jamming couldn't be easier as the program worries about hitting the right note, in the right tempo leaving you to select an instrument and move a joystick to add that finishing touch.



Whether you're a budding Beethoven, closet Chopin or a secret Sex Pistol, Instant Music will provide the right mix of ease of use, a 40 page manual will keep you on song, and flexibility, to keep you interested, and is sure to be a hit.

T.H.



Touchline:
Title: *Instant Music.* ***Supplier:*** *Electronic Arts, 11/49 Station Road, Langley, Berks., SL3 8YN.* ***Tel:*** *0753 49442.* ***Machine:*** *C64.* ***Price:*** *£9.95 (Ca) £14.95 (Disk).*

Easiprint

If the phrase "Escape Code" brings you out in a cold sweat, and the prospect of selecting the quadruple-density graphics mode on your flash new printer is enough to bring you to your knees, then EasiPrint is the program for you.

By Mark Everingham

EasiPrint is an extension to the normal BASIC operating system which provides the user with 60 (yes, I did say 60) extra commands, expressly for the purpose of controlling a dot-matrix printer linked to the Commodore serial port.

The program will work on any printer conforming to the Epson Standard, which is used by almost every type of dot-matrix printer. Of course, the large exception to this is Commodore's own range of printers. Therefore, extra commands have been added to operate either the MPS801 or MPS803 printers. The Epson commands included in EasiPrint cover every function imaginable from selecting the compressed printing mode, to disabling the paper-out sensor.

Of course, since all these functions are controlled by the printer itself, if your printer will not print double height for example, then EasiPrint won't either!

Using EasiPrint Commands

Each of EasiPrint's commands are preceded by an asterisk to distinguish them from the normal BASIC commands. When using them in a program, no other command can follow an EasiPrint command. The command must either be the only command in that line, or the last one in the line. For example:

```
10 *NLQ ON:SCNCLR
```

will turn Near Letter Quality printing on, but will NOT clear the screen. However:

```
10 SCNCLR:*NLQ ON
```

will clear the screen and then turn Near Letter Quality printing on.

When you are using an EasiPrint command in the BASIC Direct Mode (without a line-number), you must precede the command with a colon to make the interpreter execute the command as if it were part of a program. For example:

Easiprint

*NLQ ON
from Direct Mode will give a "?SYNTAX ERROR" report, but
:*NLQ ON
will do the trick (Turning NLQ on).

Command Syntax

All EasiPrint commands fall into one of the following three categories:

- They require no input parameter e.g. *PICA and *ELITE
- They require an ON/OFF parameter e.g. *ITALIC and *UNDERLINE.
- They require a numeric parameter e.g. *LEFTMARGIN and *CHARACTERSET.

Note that for type (2) commands, you must put a space between the command and the ON/OFF parameter, but if you wish to save on RAM, you can leave out the OFF leaving the effect unchanged.

For type (3) commands, the input parameter is either a number in the range 0-255 (Byte parameters) or in the range 0-65535 (16-Bit parameters). The range required is indicated in "EasiPrint commands".

If the parameter specified is of the wrong type, or is outside the valid range, then a suitable BASIC error message will be displayed and program execution stopped as for all BASIC commands.

EasiPrint Commands

Commands requiring no parameters

DISABLE – is used to disable the Easi-Print commands in case of software incompatibility, etc. To re-enable the program you can use SYS 32757. (See "Patching-in the System.")

TEST – will send a textual message to the printer in order to test that it is functioning properly.

SOCRATES – find out for yourself!

PICA – selects the Pica printing pitch on your printer. Pica is the standard point-size which is selected when a printer is first switched on.

ELITE – selects the Elite pitch on your printer. Elite is a narrower, more dense print-style providing 112 characters per line instead of the usual 80.

RESET – sends the control codes to the printer for a reset. This has the result of selecting the Pica pitch with all the special effects turned off, and resetting the default page size and margin settings, etc.

RETURN – sends the code for a carriage return to the printer.

LINEFEED – sends the code for a linefeed to the printer.

SPACE1/6 – sets the line spacing of the printer to one sixth of an inch which is the standard setting.

SPACE1/8 – similar to the SPACE1/6 command, but sets spacing to one eighth of an inch.

SPACE7/72 – sets line spacing to 7/72 inches. This value is the same as used for drawing continous line (Epson) or Commodore graphics characters, and is the setting used when the graphics modes are in action.

FORMFEED – sends a formfeed character to the printer which has the effect of moving the paper position onto the next sheet.

TAB – moves the printer's head to the next tab position across the line. Officially, this is called an HTAB (See SETHTABS.)

VERTICALTAB – moves the paper forward to the next vertical tab position (officially VTAB). (See SETVTABS.)

CANCELINE – will delete the last line from the printer's buffer. Note that it will only work if a carriage-return character has not been sent.

ONLINE – sets the printer on-line for printing, etc.

OFFLINE – sets the printer off-line for moving the paper, changing ribbon, etc.

EXPANDED – selects the expanded printing effect on a Commodore compatible printer. Another command is supplied for doing this on a non-Commodore printer. Note that if this command is sent while the printer is in bit-image mode, then the bit-image mode will be cancelled before selecting expanded print.

STANDARD – this does the reverse of EXPANDED, selecting the normal print width. Again, if this command is executed from the bit-image mode, then the bit-image mode will be cancelled.

UPPERLOWER – is used to select the upper lower character set on a Commodore compatible printer. This mode is only in operation for one line, so if the printer channel has been opened using OPEN N,4,0 then after one line, printing will lapse back into the Graphics character set.

GRAPHICS – the same as UPPERLOWER, but selects the graphics character set.

RVSON – used to select reverse video printing on a Commodore compatible printer. Another command is provided for this action on a non-Commodore printer.

RVSOFF – turns reverse printing off on a Commodore compatible printer.

BITIMAGE – will only work on a Commodore compatible printer and puts the printer into the bit image mode for performing screen dumps, etc.

JUSTIFYLEFT – will only work if NLQ printing is switched on. It formats the incoming text so that it's flush against the left margin. This is the normal mode of operation when the printer is turned on.

JUSTIFYRIGHT – works in a similar way to JUSTIFYLEFT, but keeps all text flush against the right hand margin.

CENTRE – will centre all the following text between the left and right margins.

JUSTIFYBOTH – if there are enough characters on the line, will attempt to fully justify each line by increasing the spacing between characters.

Commands requiring an ON/OFF parameter

NLQ ON/OFF – will, of course, only work with a printer, supporting NLQ, serves to turn this style of printing on or off.

DOUBLEWIDTH ON/OFF – may seem the same as EXPANDED, but this command works with an Epson compatible printer rather than a Commodore printer.

COMPRESSED ON/OFF – switches on or off the compressed pitch, which effectively doubles the number of characters per line.

PORPORTIONAL ON/OFF — turns the proportional printing mode on or off. Proportional printing is such that each character only takes up as much space as it needs (See INCREASE.)

EMPHASISED ON/OFF – turns emphasised printing on or off. When turned on, each character is printed twice in one position, and then one dot across. There is no significant decrease in printing speed.

DOUBLESTRIKE ON/OFF – switches on or off the doublestrike printing. With doublestrike printing on, each line is printed, then printed again on top of the first one. This means that printing speed is halved.

ITALIC ON/OFF – is used to turn italicised printing on or off.

UNDERLINE ON/OFF – serves the purpose of switching underlining on or off.

REVERSE ON/OFF – turns reverse video printing on or off on an Epson compatible printer. It cannot be used on a Commodore printer as the control codes are different, which is why it has been duplicated.

SUPERSCRIPT ON/OFF – selects whether the superscript typeface is to be used. The superscript style is half the height of normal printing, and appears in the top half of the line.

SUBSCRIPT ON/OFF – does the same as SUPERSCRIPT, but selecting Subscript printing. This is similar, but characters appear in the lower half of the line. Note that the control codes for switching Superscript or Subscript off are the same, so SUPERSCRIPT OFF will turn Subscript printing off, and inversely SUBSCRIPT OFF will turn Superscript printing off.

DOUBLEHEIGHT ON/OFF will switch the double height printing on or off. This effect is only available on some printers.

DOWNLOAD ON/OFF – used to select whether the ROM character set of the printer is used, or the RAM character set. Note that to use the RAM character set, the data for it must first be downloaded. Since this requires many parameters, a command has not been provided for the purpose. (See your printer manual.)

UNIDIRECTION ON/OFF – tells the printer if it is to print bi-directionally (printing while moving in both directions) or only in one direction. The unidirectional mode is used when exact alignment of characters is required on consecutive lines.

SLASHEDZERO ON/OFF – used to define whether a zero printed on the printer has a slash through it or not. Slashed zeros are more practical for program listings, but unslashed zeros look better.

PAPEROUT ON/OFF – enables or disables the paperout sensor. This is useful when using a single-sheet feeder.

Commands requiring a numeric parameter

INCREASE 0-255 – takes a parameter in the range of 0-255 and increases the spacing between characters when proportional printing is selected. The input value is the increase in dots.

CHARACTERSET 0-255 – selects which of the international character sets is to be used for printing. Usually the printer has eleven character sets in the range of 0-11 and these are as follows on a Commodore compatible such as the Citizen 120D.

0 – U.S.A.	7 – Spain
1 – France	8 – Japan
2 –Germany	9 – Norway
3 – England	10 –Denmark #2
4 – Denmark #1	11 –Commodore
5 – Sweden	
6 – Italy	

PAGESIZELINE 0-255 – used to tell the printer how big each piece of paper is. The input parameter is the depth in lines and is typically 66 lines.

PAGESIZEINCH 0-255 –used to define the paper size, but this time it is defined in terms of inches. The size of a normal piece of computer listing paper is eleven inches.

LEFTMARGIN 0-255 – sets the left margin to the input value in characters. Usually this value will only be in the range of 0-80.

RIGHTMARGIN 0-255 – identical to the LEFTMARGIN command, but sets the right margin position.

SETHTABS 0-255 – identical to the LEFTMARGIN command, but sets the right margin position.

SETHTABS 0-255 – defines where on a line the horizontal tab positions are. The input parameter is 'every n characters'. For example, if you want tab to tab, use the TAB command.

RELATIVETAB 0-255 – used to move the print head position. The input parameter is the number of characters for it to move. For example, RELATIVETAB 10 moves the head ten characters to the right.

DOTABSOLUTE 0-65535 – takes a 16-bit parameter and is used to set the print position in terms of dots. The input parameter is an absolute dot position, and the command will move to that position from wherever it is on a line.

DOTRELATIVE 0-65535 – the same as DOTABSOLUTE except that the input parameter is a relative position. For example, to move the head 320 dots to the right, use DOTRELATIVE 320.

SETVTABS 0-255 – similar to SETHTABS and is used to define where on a page the vertical tab positions are. Moving from one vertical tab to another is performed using the VERTICALTAB command.
ADVANCEPAPER 0-255 – moves the paper forward a number of lines. It can be used for label printing or moving over letterheads, etc.

SINGLEDENSITY 0-65535 – used to select the single density graphics mode on an Epson compatible printer. The input parameter is the number of dots per line. The only way of leaving a graphic mode is to print a full line of graphics.

DOUBLEDENSITY 0-65535 – performs the same action as SINGLEDENSITY, but selects the double density mode running at low speed for extra accuracy. Again, the input parameter is the number of dots per line.

FASTDOUBLE 0-65535 – identical to DOUBLEDENSITY, but selects the double density mode running at high speed. The result of this is that columns of graphics are a little further apart, but speed is kept at an optimum.
QUADDENSITY 0-65535 – the same as the preceding commands, but selects the quadruple graphics mode which prints four times as many dots in a given width than the single density mode.

Patching in the System

The BASIC Loader Program

The BASIC Loader program is used to POKE the machine code for EasiPrint into RAM. To perform this, simply type in the program and RUN it. Any data errors will be reported. If the data is correct, the program will prompt for tape or disk, and then save the BASIC program, and the machine code file.

Using EasiPrint in your own programs

The first lines of your program must be the following:

```
10 IF L%=0 THEN L%=1:LOAD
"EASIPRINT CODE",8,1
20 POKE 55,121:POKE 56, 120:CLR
30 SYS 32757
```

Line 10 loads the EasiPrint machine-code. If you are using tape instead of disk, then change the ,8,1 to ,1,1.
Line 20 sets the top of memory pointers to protect the machine-code. This leaves about 25K free for BASIC.
Line 30 enables the EasiPrint commands.

Note that all commands that EasiPrint sends to the printer are sent through channel number 14. It is unlikely that this channel is used in any of your programs, but if it is, you must change this to another number.

Since the EasiPrint program is wedged into the Execute Command routine through the vector at $308, rather than the CHRGET routine, it should remain compatible with most other language extensions such as DOS 5.2.

The Demonstration Program

This short program serves as a demonstration of programming using EasiPrint. It is entered and RUN in the normal way, but if you are using tape instead of disk, change the ,8,1 in line 10 to ,1,1

Changing EasiPrint for Other Printers

It is not feasible to redefine the actual commands themselves included in EasiPrint, as their texts are tokenised (i.e. DOtABSolute). However, if you have a non-standard printer, it is possible to change which control codes are sent to the printer, or to disable certain commands. There are three types of commands – no paramaters, On/Off paramater, and numeric parameter. Each of these is stored in a different format in RAM as shown below:

No Parameters

BYTE: 01234567890123456789012
DATA: COMMAND NAME/CODE/-----

The Command Name, which is stored in the same format for all types of commands, is the tokenised command text e.g. italic. It can be 12 tokenised characters long maximum. Each command is terminated with a CHR$(255) to mark the end.

The Code is the set up of four control codes to be sent to the printer, stored as one byte number. Again, these are terminted with a CHR$(255).

On/Off Parameters

BYTE: 01234567890123456789012
DATA: COMMAND NAME/ON../OFF./

The Command Name is as above. The ON.. and OFF. are the control codes for respectively turning the function on or off on the printer. Again, they can be up to four characters long each, and are terminated with a CHR$(255).

Numerical Paramaters

BYTE: 01234567890123456789012
DATA: COMMAND NAME/CODE=?

The Command Name is as above. The Code is the set of control codes to be sent to the printer. Next comes = which is a CHR$(192) character. After this is a ? character which tells EasiPrint which sort of parameter to expect. They are encoded as follows:

$C1 – Expect Byte Parameter

$C2 – Expect 16-Bit Parameter

When EasiPrint finds the CHR$(192) character, it then sees what sort of input is needed, gets this input and then sends the input value to the printer. If the value is 8-Bit, it is sent as a normal CHR$ code, but if it is 16-bit, it is sent as two 8-bit CHR$ codes, least significant byte first.

Changing EasiPrint Control Codes

By now, you should have a reasonable idea of how EasiPrint data is stored in RAM. To change the control codes for a certain command, the procedure is shown below. The example shown is to change the control codes sent by *NLQ to (ESC)NL1 to turn NLQ on, and (ESC)NL0 to turn NLQ off, as might be the case in a non-standard printer.

• Turn the control codes into hexadecimal bytes:

ON TEXT: (ESC) 'N' 'L' '1'
ON HEX: $1B $4E $4C $31
OFF TEXT: (ESC) 'N' 'L' '0'
OFF HEX: $1B $4E $4C $31

Because each set of control codes is stored in a fixed field of 5 bytes, we must add a $FF to signify the end of the control sequence. Therefore, we have:

HEX: 1B 4E 4C 31 FF 1B 4E 31 FF
On Of

• Calculate the address at which the data is to be stored:
Address for *NLQ is $76D (See Command Reference.)
Add 13 to this to skip over the command names:
New address: $7C7A
• Poke the bytes into RAM.
Enter TEDMON using MONITOR (Return)
Enter the bytes:
>7C7A 1B 4E 4C 31 FF 1B 4E 4C (Return)
>7C82 31 FF (Return)
• Save a new copy of EasiPrint:
Insert a new disk or tape and type:
S "EASIPRINT CODE",8,7879,8000 for Disk Users
S "EASIPRINT CODE",1,7879,8000 for Tape Users
Finally, exit TEDMON and return to BASIC by typing: X (Return)

As you can see, it's no easy job, but unless you have a very interesting printer, it should not be necessary to perform the above!

See listings on page 74.

MICRO MUD

Question. When is MUD not MUD? Answer. When it is a computer game. Confused? You will be. MUD is an acronym for multi-user dungeon. The original idea was that several people participated in the adventure simultaneously, connected to a mainframe via a modem.



Character interaction was the name of the game. Now, because not many people have access to a modem, Virgin have brought out a one player version of the game.

But doesn't that kill the whole *raison d'etre* behind the game I hear you all screaming. Well yes and no. For the game comes complete with a character disk containing details of one hundred fellow adventurers, ten of whom are picked at random to go adventuring with you whenever you load the game. Obviously, the degree of interaction is nowhere near as high as in the orignal but the flavour of the game is still retained.

The objective of the game is to reach the exalted level of wizard or witch by scoring more than 102400 experience points. Points can be gained in three main ways. Collecting and storing treasure, killing an opponent or performing some minor task. If you want to become a wizard by kicking the beggar 102400 times, then so be it.

To collect treasure, it has to be dropped in the swamp where it sinks without a trace. This might seem pretty drastic but it does stop the other players from grabbing it.

Because the amount of treasure available is finite, the game resets every forty to sixty minutes restoring everything to its former position. This is something else that you must come to terms with. MUD is played in real time so there is no point in hanging about. Similarly, different actions take different lengths of time and the game carries on while these are being performed.

Killing an opponent garners you one twelfth of his experience points. The disadvantage here though is that you could get killed yourself. You have no say in combat once it has been initiated but must just sit back and await the outcome, which depends on the player's strength, dexterity and stamina ratings.

There are two ways of dying in MUD. Dead and dead dead. The latter occurs when you are defeated in combat and means game over time. Your character is irretrievably lost. Dead occurs when you try to do something silly such as leaping off the cliff without a parachute. You are kicked out of the game and lose all awards for that session.

There are various magic spells that you can use. Anyone can attempt to cast one but the chance of success depends on your skill level at the time and there could be dire consequences if one goes wrong on you. So don't try casting Finger of Death when you first enter the game.

Most of the commands can be abbreviated to save you from typing errors if you are trying to do something quickly. Commands can be linked with 'and' or 'then' which gives the parser a reasonable degree of sophistication although nobody would ever claim that it was supposed to be the game's strong point.

It is worthwhile finding out which characters are present at any stage in the game. You will need their help on several occasions. The 'shout' command sends your message throughout the land. With a bit of luck, some of the others might even respond. Remember to reward anyone who does help you. You don't want to be ambushed on the way back to the swamp.

There are some 400 locations for you to explore – cottages, graveyards, caves, forests and of course, the bottom of the cliff together with anything that might be out at sea. Descriptions are of medium length, again to stop you from being killed while you read them.

The packaging consists of a thirty page manual together with a copy of the book 'An Introduction to MUD' which gives details of the mainframe game. Although the one player is largely the same, there are some significant differences.

A one player version of MUD can never hope to capture the spirit of the original entirely, although Virgin have made a tremendous effort and their version of MUD is one that every adventurer should own. At fifteen pounds, it offers tremendous value for money with the added advantage of no phone bills to pay afterwards. Now, if you will excuse me, there is a certain necromancer who is due for his comeuppance after what he did to me last week. **G.R.H.**

Touchline:

Title: *Micro MUD.* ***Supplier:*** *Virgin Games, 2-4 Vernon Yard, Portobello Road, London W11 2DX.* ***Tel:*** *01-727 8070.* ***Price:*** *£14.95 – disk only.*

Fred Goes Dotty

Dot matrix printers have had it too easy for too long! These three packages from Financial Systems Software will really put them in top gear!

By Fred Reid

There are a great many graphics utilities around that C64 owners can avail themselves of – many of high quality and special features, but few will see the job through to the end – in most cases, hard copy!

Photo Finish (not a race horse in sight), Billboard and ICON Factory are stand alone packages, each with their own particular function. Treating yourself to any or all of these packages is like giving a chainsaw to a beaver!

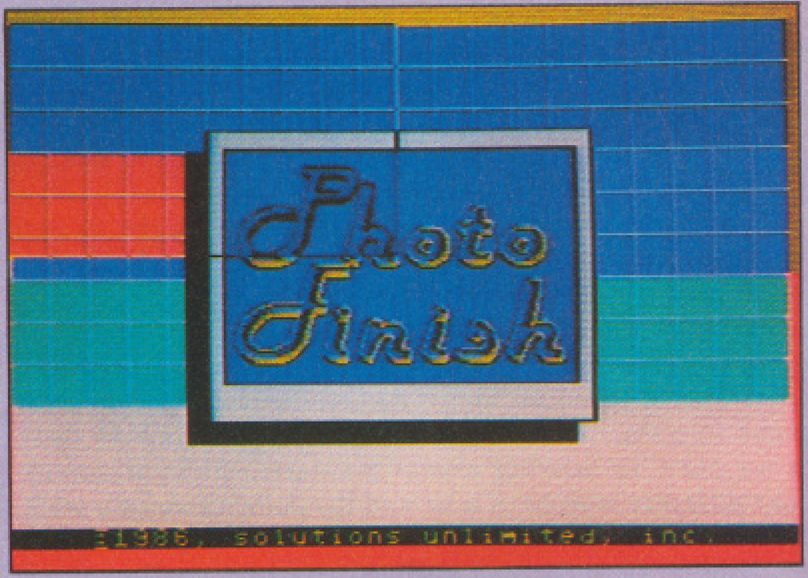
Photo Finish

Photo Finish is the perfect complement to ICON Factory, enabling you to transfer your finished pictures to paper. There are countless 'hi-res screen dump' programs in circulation, but Photo Finish stands a full head and shoulders above the rest. As with ICON Factory, Photo Finish can cope with many different image formats.

Hi-res pictures pose no problems, as your printer only has to reproduce the foreground colour (unless you decide to print a negative of the original, in which case only the background is printed).

Multi-colour pictures need to be treated slightly differently, as each colour on the original picture has to be converted into a shade of grey before the printer can make sense of it! Photo Finish offers the facility to design your own grey scales or use the default scale. Because a dot matrix printer can only print a dot or NOT print a dot, each of the C64's colours can be assigned a shade block – the more dots in the shade block, the darker that colour is represented on paper! If that sounds complicated, it's not, just a little difficult to explain

Photo Finish also makes use of the Optimizer, allowing you to print four times the dot density of normal hi-res screen dumps, improving the finished product no end.



Printers are fickle things at the best of times, so much depends on the make of your printer, the make of interface and how you set all those annoying DIP switches. There isn't any easy solution here, but Photo Finish makes the best of the situation by offering several 'standard' printer definitions, plus the capacity to define a non-standard printer. I used a Citizen LSP 10 with a Micrografix interface and had no problems.

ICON Factory

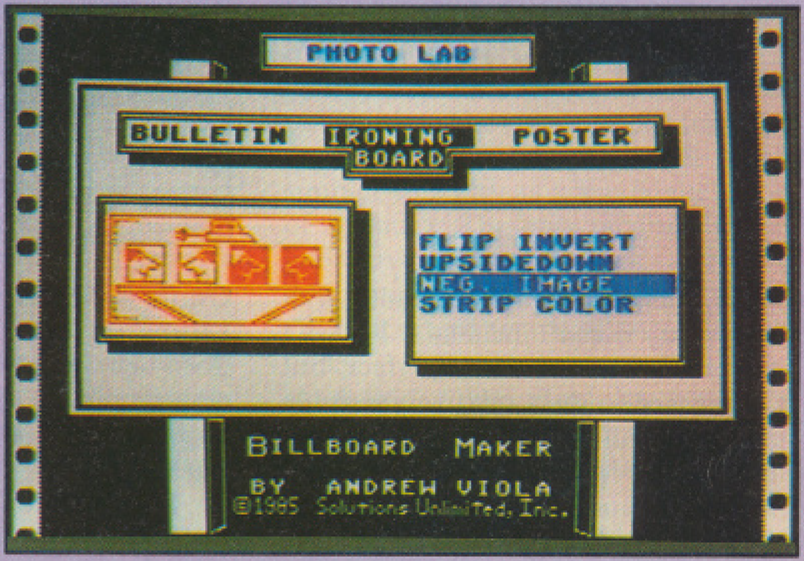


ICON Factory is literally an Image CONverting system that can be used to mix and match images from the most popular C64 graphics packages; Printshop, Newsroom, Koala Pad, Blazing Paddles, to name but a few. You could be forgiven for mistaking ICON Factory for a game, such is the quality and attention to detail.

The main menu screen is designed as a 'factory building' – each of the factory windows is a scrolling menu for one part of the program. F1 selects the 'window', while cursor up/down scrolls through the options. Once an image has been loaded into memory there is very little you can't do with it. ICON Factory has another unique feature, called 'Optimizer'. When you are enlarging graphics, Optimizer attempts to ADD detail, smoothing out ragged lines. This could cause problems if you try to enlarge a graphic too many times with Optimizer turned on – the end result would be a shapeless blob! Practically though, Optimizer can add that professional touch to your artwork.

Let's take a typical application; a Printmaster graphic can be blown up to full-screen size, cropped, overlayed on a Koala Pad picture and saved as a Blazing Paddles file with just a few simple operations.

Billboard



Billboard Maker completes the trio, with the unbelievable ability to blow up your pictures to an incredible four feet by three feet! Before you turn away in disbelief, with crys of "Where can I get paper that big?" and "April Fool's day was last month!", let me explain. Billboard prints out on your normal A4 size paper, but it breaks the super-enlarged picture up into strips. You then stick the strips together to make up the finished picture!

Once again, the presentation of this package leaves nothing to be desired. The theme this time is not a factory, but a printing works, complete with photo lab, art department, typesetting room and a switchboard to help you find your way around.

Everything you need to turn a picture created on, say, Koala Pad into a full size poster is under the one 'roof'!

The photo lab lets you load a picture and change its appearance using the menu options to strip away the colour, crop the picture to the right size, add borders and generally tidy things up. The Optimizer re-appears here, and can be selected to smooth out your picture. The typesetter's office is where you add text to your pictures, in a variety of fonts and styles, prior to printing. Finally, the printing press is where your creations become reality!

Throughout the package, the menu system (similar to Photo Finish and ICON Factory) is a delight to use. Billboard Maker is by far the most complex package of the three but the results more than justify this; be prepared to spend some time reading the manual though!

General Comments

All three packages are beautifully presented, carefully documented and sensibly priced. While all three will set you back a few quid, it must be stressed that each package is designed to run independently of the others, while still complementing them.

If you are in any doubt as to whether or not you can use Photo Finish or Billboard maker with your printer and interface, the answer is probably YES! However some hardware combinations could prove troublesome and I strongly suggest you purchase your package from a dealer likely to offer support if you run into trouble.

Touchline:
Products: *Photo Finish, Billboard, ICON Factory.* ***Supplier:*** *Financial Systems Software Ltd, Anbrian House, St. Mary's Street, Worcester WR1 1HA.* ***Tel:*** *0905 611463.* ***Price:*** *£24.95 each.*

Star LC-10 Printer

In the search for daisywheel quality at dot matrix speed, we look at the latest twinkle in Star Micronic's eye

By Eric Doyle



Hallelujah! At last a printer with a decent manual. I don't mean that it's perfect but I'm pleased to see a relatively sensible layout, a pull-out guide sheet and an index. The printer itself is rather impressive and at last Star Micronics seems to be coming to grips with the needs of the user.

Star's LC-10 is a dot matrix printer of the latest generation offering more than the usual options of various international character sets; NLQ (high quality) or draft printing styles in a variety of typefaces, italics, graphic mode, user-definable characters, subscript and superscript, underlining and overlining, proportional spacing. Page formatting also follows the tried and tested options to give differing page widths and lengths, tabs, centring, left and right justification, various line spacings, and macro instruction strings but what makes this machine 'new' are the extra options.

The Epson standard is impossible to define accurately because every time the opposition start scoring against them, Epson moves the goalposts. Star always offer Epson compatibility and in the past this has meant pica, elite and condensed type styles with italic options. Star have now added various typefaces to the standard set of NLQ Courier characters with Sanserif and Orator styles. An example is given in Listing 1. No longer does every document have to look the same, new emphasis can now be given to important passages by varying the typefaces.

The printer can also handle tractor-fed continuous stationery or hopper-fed single sheets for headed notepaper or one-off printouts. The tractor feed has migrated from its usual position over the platten and print head to become a push feed system. Now, instead of the paper being pulled through the printer and over the platten, it is pushed towards the platten. This has two advantages. The first is a super sleek appearance to the printer and the second is one of paper economy.

When lacing up tractor-fed paper a leading sheet had to be wasted so that the paper would engage on the sprockets after being fed between the platten and the print head. With the new push feed the paper meets the sprockets before reaching the platten. This is especially advantageous when using peel-off address labels because a run can start with the first label on a sheet instead of starting at the beginning of the second sheet.

Another new implementation is the ability to automatically 'park' continuous stationary to allow single sheets to be used. By pressing a certain combination of buttons on the very useful front control panel, the paper is pulled out of the printer by the sprockets leaving the paper path clear.

Listing One – LC 10 sample printout

```
Type styles are:
        Draft characters, Courier characters, Sanserif characters, ORATOR WITH
SMALL CAPITALS, OR Orator with lower case characters AND italics for all styles.

Print pitches are:
        Pica pitch, Elite pitch, Condensed pica pitch, Condensed elite pitch , proportional spacing for all
 pitches.

Expanded, Double Height
Double sized, or Quad sized.

Also included are:
        Emphasised, Double Strike, Underlining, SUPERSCRIPT, SUBSCRIPT, and
OVERLINING
```

SPECIFICATIONS:

Printer Type:	Serial impact dot matrix
Printing Method:	Draft – selectable bi- or uni-directional, logic seeking NLQ/Graphics – uni-directional, logic seeking
Ribbon:	Black, fabric-ribbon cartridge
Buffer:	4K normally, single line buffer when using download characters
Draft Typefaces:	Draft, draft italic
NLQ Typefaces:	Courier, Sanserif, Orator (with lower case or small capitals), plus italic versions of all
Characters:	96 ASCII characters standard, 244 ASCII, graphics and international characters in IBM mode
Download Set:	192 draft, 78 NLQ
International:	14 sets (USA, France, Germany, England, Denmark I and II, Sweden, Italy, Spain I and II, Japan, Norway, Latin America, Denmark/Norway)
Special Styles:	Double width, double height, double width and height, quadruple width and height
Print Pitches:	Pica (10cpi), elite (12cpi), condensed pica (17cpi), condensed elite (20cpi, draft mode only), proportional spacing
Line Spacing:	1/6 (standard), 1/8, n/72, n/216 inch
Column Width:	8 inches – 80 characters pica, 96 chars elite, 137 chars condensed pica, 160 chars condensed elite
Dimensions:	384mm x 287.5mm. Height 108mm
Weight:	4.7kg
Power:	30W (60W max)

A sheet of headed notepaper can then be fed through for an urgent business letter without creating the need to unlace the continuous roll manually, feed in the single sheet, and then relace the original roll manually.

The front panel which I mentioned also allows the selection of one of the three typefaces in NLQ modes. The panel also allows these to be designated as italic or roman styles in pica, elite or condensed pitch with or without proportional spacing. This is all in addition to more usual features such as forward and backward micro-feed for aligning the paper, form feed to test the software specified page length, on/off line selection and power switch indicator. Other panel selectable options permit hex dumps of raw code for software bug tracing, a long or short self-test to check that the printer is operating properly, printer buffer clear, top of form and margins setting.

At last the Centronics connection socket has been moved from its normal position on the back of the printer where it often hindered paper feeding to a more sensible position on the right-hand side of the casing. Although it was Centronics' version which I tested there is a Commodore serial interface model available. I'd strongly recommend that this option is taken up because the printer interface that I used to convert my 64C for Centronics connection malfunctioned several times even though it has worked happily with earlier Star printers.

One move which I do not approve of is that the DIP switches which are used to select the power up options on the printer are tucked away inside the machine. On my earlier Star SG-10 printer these were positioned at the left-hand side in a recess for easy access. I have an aversion to DIP switches at the best of times, they are small and awkward to set and I would have preferred to have seen a sensibly positioned covered panel with larger slider switches.

The manual gives two example listings in PC style Microsoft Basic which can easily be converted for the Commodore. One listing shows how commands can be issued to the printer through software and the other is a very useful character designer. If you think you can improve on the typefaces included in the printer's operating system or if you need to design a character for a specific use, the Download Character Generator will give you a grid to work from for both NLQ and draft mode characters. Anyone who has tried to define their own characters will know what a headache this can be and I welcome this listing from Star.

The rest of the manual shows a departure from Star 's usual style of overplaying instructions. Here each facility is given a few lines with a nice bold title. The ease of finding the facility which you need is made much simpler this way as does the inclusion of an index. The only facilities which are given extra space are the descriptions of download, user defined characters and setup and maintenance notes.

A final round of applause is given to Star because the printer head is easy to replace. Although years of use can be expected from a print head, accidents do happen and the expense of having to have the head replaced by a professional can prove inhibitive.

Mechanically, the printer is well constructed and all of the working parts are readily accessible. The one Achilles' heel is the cover for the drive sprockets which clips into place but doesn't seem very resilient. On the machine supplied for review, the cover clips barely held the cover in place. Normally this would be a very minor complaint but on the LC-10 the semi automatic, sheet hopper attaches onto this cover and the floppiness could cause problems.

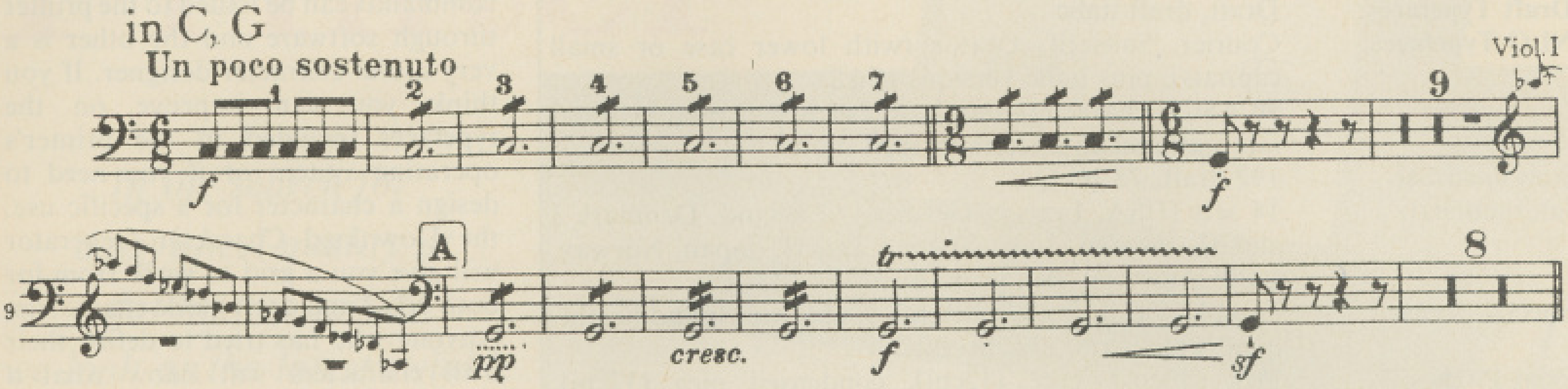
With the LC-10, Star Micronics has placed a handsomely styled, professional-quality printer within the grasp of the home user – my advice is to grab it with both hands. YC

PRINT SPEEDS

Specified:	120 characters per second (draft pica) 30 characters per second (NLQ pica)
YC Benchtest:	90 characters per second (draft pica) 20 characters per second (NLQ pica) 62 characters per second (sample document draft pica 17 characters per second (sample document NLQ pica

Touchline:
Machine: *Star LC-10 dot matrix printer.* ***Supplier:*** *Star Micronics UK Ltd., Craven House, 40 Uxbridge Road, Ealing, London W5 2BS.* ***Tel:*** *01-840 1800.* ***Price:*** *£229 + VAT.*

Making Music



Continuing our music series, this month we look at the Commodore's ability to synthesise and the all important role of interrupts

By Peter Gerrard

Any *true* synthesiser must make extensive use of interrupts to be able to cope with the musical demands put upon it, at least on the Commodore 64. I'm not suggesting that Mr. Moog had a thorough working knowledge of interrupts (but you never know...)! However, it is possible to lay the ground work, and produce a program at the same time that will stretch the C64 to its limits.

The Role of the Interrupt

The interrupt's main function is to play background rhythms, which in turn allows the features of ring modulation and synchronisation to be used to their full extent. Editing features can be used to put these rhythms into memory, or indeed produce the data for vast musical soundtracks that can be played back later using a totally different program, but still running under interrupt control.

For now, however, we are more concerned with the simple playing of notes on a keyboard, and gaining knowledge of the various aspects of the SID chip before committing our magnum opus to memory (tape and disk as well probably); the end result will be all the better for it.

Fiddle about to your heart's content, altering anything and everything as you see fit. But do remember that there might be other people listening in, and your idea of a number one hit album, film soundtrack, or whatever, might not necessarily coincide with theirs!

The Actual Program

The screen display is initially divided into two parts. To the left of the dividing line there are three rows of musical keys covering three octaves. To play a note using any of those rows of keys then press a key from 'Z' to 'M' for the bottom row, 'A' to 'J' for the middle row, or 'Q' to 'U' for the top one. The little sprite face will follow you around, just to let you know what you are.

On the right hand side of the dividing line are some simple instructions and a few facts of information. At the top of the screen you'll see a small display telling you which keys to press to produce a note. The function keys are also indicated, and in the order F1 to F8 they play chords in the keys of C, D, E, F, G, A, B and C again respectively. These chords are played in the same octave as that currently being used by the bottom row of the on-screen keyboard, or in the computer's terms, the keys 'Z' to 'M'.

To change octaves, you will see that you can press the ' ↑ ' to go down an octave, or the ' @ ' key to go up an octave. Since there are limits beyond which you and I cannot hear anything, but any surrounding pets might be driven beyond endurance, the 64 is kept to a certain limit with its octave range, but can nevertheless cope quite happily with about an 8 octave span. All of these are available using this program.

You'll see on the next line down the mysterious term *glissando*, but any fan of Steve Hillage will tell you what this is all about. Pressing the '*' key turns the glissando effect off or on (toggles it, in other words), and

although this feature only works on voice one it can be used to produce some startling sounds. Glissando is, basically, a musical term meaning "the effect produced by sliding the top or back of the finger over piano-forte keys or harp-strings, or along fiddle-string, or by "scooping the voice" according to my Reader's Digest Great Encyclopaedic Dictionary.

Slip Sliding Away

The important thing to remember here is the 'sliding' part, because a glissando effect (in terms of our program) is one which slides a note from one value to another, at a varying speed dependant on the glissando rate selected (chosen here by pressing the '=' key to vary the rate from 0 to 8). To put it another way, it is possible to coast happily from C in one octave to C about two octaves above it, playing all the frequencies in-between at a pre-selected rate. So what? Well, apart from sounding very pretty, try using it when other voices are being modulated or synchronised with voice one. The effects are very, very interesting, and are just the sort of thing that would have Steve Hillage drooling over his woolly hat and old hippies lighting joss-sticks everywhere. To you and me, it produces a highly individual sound effect.

Below that, we can see that by pressing the keys 1-7 a variety of voices can be turned on and off. How does the program choose three voices from a selection of keys 1-7? Well, it all works on a binary basis, so that pressing the following keys has these results…

Key pressed ^{5} 1 2 3 4 5 6 7
Voices Active ^{5} 1 2 1/2 3 1/3 2/3 1/2/3

As you can see, pressing key '1' simply turns voice one on, pressing key '5' turns on voice one and three, pressing key '7' turns on all three voices, and so on for all points in-between. A simple way of using the minimum amount of keys to produce the maximum amount of result.

Further on down the right hand side of the screen you'll see that pressing the RETURN key allows you to alter the characteristics of the voices, and pressing that key takes you into another menu where the waveforms, ADSR settings, ring modulation and synchronisation for all three voices can be altered to your heart's content.

Finally, you'll note that the CTRL key gives you control over the filtering parameters, and pressing *that* key gives you access to a further menu, this time allowing you to select which of the three voices you want filtered, what sort of filter you want, what sort of resonance you want, and finally what the cutoff frequency is to be. After that, back to the main display and the chance to listen to the fruits of your labours.

One or two other keys, not mentioned on the screen, produce results as well. Pressing the '+' key turns all the waveforms off (silence!), and pressing keys '£', '[CLR/HOME]' and '[INST/DEL]' will allow you to selectively turn off the waveforms for voices one, two and three respectively. Just a simple way of achieving a blessed silence.

Later on we'll be adding to this program, when we look at the section on interrupts. When you've quite finished, it's time to (almost) say goodbye to Basic and to start delving into the murky depths of machine code on the Commodore 64. But don't worry, you'll be able to use the programs and routines presented even if your knowledge of machine code is as good as my knowledge of the workings of the House of Commons. I know that a lot of things in there make a lot of noise, and that's precisely what we're going to be doing!

Sound and Machine Code

We've lamented the absence of any specific commands for dealing with sound on the Commodore 64 other than a straightforward POKE and PEEK before now. No SOUND commands, no ENVELOPE commands, and so on. While this is, in one sense, a very good thing, as it means that anyone playing about with sound has got to know an awful lot about the workings of the sound chip before they can get anything to happen, in another sense it is most certainly *not* a good thing. This is because all but the most determined of people would surely be put off by the sheer welter of POKEs to go through before even a single note can be played, the myriad of control registers and locations to remember, and even the vast number of multi-purpose registers that needs to be taken into account before the required sound can be produced with confidence and competence.

In the absence of anything else, of course, there's always the option of going out and buying something like a *Simon Basic* or some other 'command-adder'. Sadly, this would mean that any great works composed using these aids would not be able to work on anyone else's Commodore 64 unless they too had the same utility. Consequently, it is always better to produce some homemade extensions to Basic that can, if necessary, be carried within the heart of the program using them.

Tools of the Trade

Let's look at how in theory, a number of aids could be added. They're not extensions exactly, but rather additions to the normal Basic repertoire. They should be in the form of SYS calls, but since we can SYS for variables as well as numbers, we'll only have to set variables like VOLUME, SOUND, ADSR, FILTER, WAVEFORM etc. at the start of the program, and could then rely on the following:

```
SYS VOLUME, 15
SYS WAVEFORM,17,1,1
SYS ADSR,9,0,0,255
SYS FILTER 1,2
SYS FREQ 8,1500
SYS SOUND,147,8
```

to set up everything required to make a few noises. Always remember, though, when using variables of this nature, that the C64 only uses the first two letters of a variable name and discards the rest. Therefore that SOUND would be equivalent in 64 terms to SOLID. also, we cannot have variable names like SONAR, as that contains the Basic keyword 'on', and the 64 doesn't like you using Basic keywords as part of variable names.

So, how do we go about setting up a series of commands like the above mentioned ones? Well, first of all we'll need to make use of a number of internal ROM routines for setting up and receiving parameters. The first of these is at $AEFD, while the second lives at $B7EB. To use them, a simple program like this could be used:

```
10 I=0
20 READ A:IF A < > -1 THEN POKE
49152+I,A:I=I+1:GOTO20
30 END
100 DATA 32,253,174,141,33,208,32,
235,183,142,32,208,96
```

```
110 DATA-1
```

Having entered and run this program, you could then type in:

```
SYS 49152,0,12
```

and see a perfectly hideous screen display as a result. The point is, however, that it works, and it is possible to pass parameters to and from machine code routines without any undue fuss and bother. To go from screen to sound is a simple matter, and if need be, it is possible to put a triangle waveform in voice one so we could change our data to read:

```
100 DATA 169,00,141,04,212,32,253,
174,10,10,10,10,105,01
101 DATA 141,04,212,96
```

which would mean a call of SYS 49152,1 would put a triangle wave in voice one, or SYS 49152,2 would put a sawtooth wave there, and so on, without the need to POKE 54272,0:POKE 54272,17, or whatever.

However, none of this is really any great improvement on the standard PEEK ... POKE approach. Use it and play with it by all means, but do not expect miracles as a result of doing so. Far better to stick to old friends, and use the speed and power of machine code to do other, more dramatic things. SYS calls to variables are all very well, but it doesn't take *that* long for a sequence of, say, five POKE commands to be obeyed. Longer than in machine code, yes, but not significantly so in terms of sounds produced. So, we must use machine code for those parts of a program where we cannot possibly begin to use Basic, and chief among these must be in the use of interrupts.

As I said, feel free to play about with passing parameters from a Basic call to a machine code routine. However it is much better to reserve machine code for something which is really useful rather than a minor saving of one or two bytes and an extension to Basic that doesn't really make life any easier.

Using Interrupts

Every fiftieth of a second or so the 64 whizzes away from whatever it's doing, and goes off to update the internal clock, check on a few operations, before returning to normal and letting Basic and everything else proceed as if nothing has happened. The routine to do this starts at $EA31, and if we can interrupt this routine and perform a few housekeeping chores of our own then we can create the impression of a multi-tasking computer. That is, one that is capable of doing more than one thing at a time. It won't be, of course – it will merely be doing several different things very quickly. But, by judicious use of code, we can make this multi-tasking look very realistic indeed.

It is this interrupting of interrupts that gives us the ability to produce, among other things, background musical soundtracks for our normal Basic (or machine code for all matter) programs. Later we'll be looking at how soundtracks can easily be made to last up to ten minutes and beyond, by taking up very little memory at all.

To interrupt the 64 on its way we must remember three golden rules:

- Make sure you interrupt the 64 properly.
- Make sure that your own code works.
- Make sure that the 64 gets to $EA31 in the end.

This may seem obvious, but it's surprising how often, and how easily, things can go wrong!

First of all we'll need to interrupt the 64. There are two memory locations used to control the final whereabouts of this interrupt, which incidentally is termed the Hardware Interrupt Vector, or HIV, and these are locations 788 and 789. If we simply PEEK these we'll see that they initially contain the values 31 and EA, and reversing things around in the time honoured tradition of the 64 brings us to the final location of $EA31.

Now suppose we want to have the 64 perform some chore of our own before it gets to $EA31, and that our own code starts at location $C000. A convenient place, being the start of the 4K spare block of RAM above Basic and some of the ROM, but below the sound and graphics work area and the rest of the ROM. We would need, first of all, to split $C000 up into two components, namely $C0 and $00, and then convert these two numbers into decimal terms. Obviously $00 is going to be equal to zero in whatever counting system you're working in (don't all write in at once, please!), and $C0 converts to 192 in decimal. Swapping those numbers around gives us a 192 and a 00 to POKE into the two locations mentioned earlier, and to alter the HIV we could just:

```
POKE 788,00:POKE 789,192
```

However, due to the speed of the 64 this will sometimes cause a 'crash', where the machine just gives up in disgust and will have nothing to do with you. Better then to have a little routine in machine code which we can call to turn the HIV to our new location, or revert to its old location, depending on which we want to do at the time. The following program will load some code into the top end of memory and enable us to get from one to the other.

```
 10 FOR I=0 TO 21
 15 READ A
 20 POKE 52992+I,A
 30 NEXT I:END
100 DATA 169,00,141,20,03,169,192,141,
21,03,96
105 DATA 169,49,141,20,03,169,234,141,
21,03,96
```

Type in this program, but don't run it yet! We have no code in $C00 yet, so add the following to the program, and change line 30 to read 30 NEXT I

```
40 FOR I=0 TO 7:READ A:POKE
49152+I,A:NEXT I:END
150 DATA 169,41,141,00,04,76,49,234
```

Nothing too startling yet, because all this does is put a heart into the top left hand corner of the screen. However, it is impossible to get rid off, without removing interrupts, and so it does at least serve the purpose. To get our heart up there we must:

```
SYS 52992
```

and to turn interrupts back to normal again we'll have to:

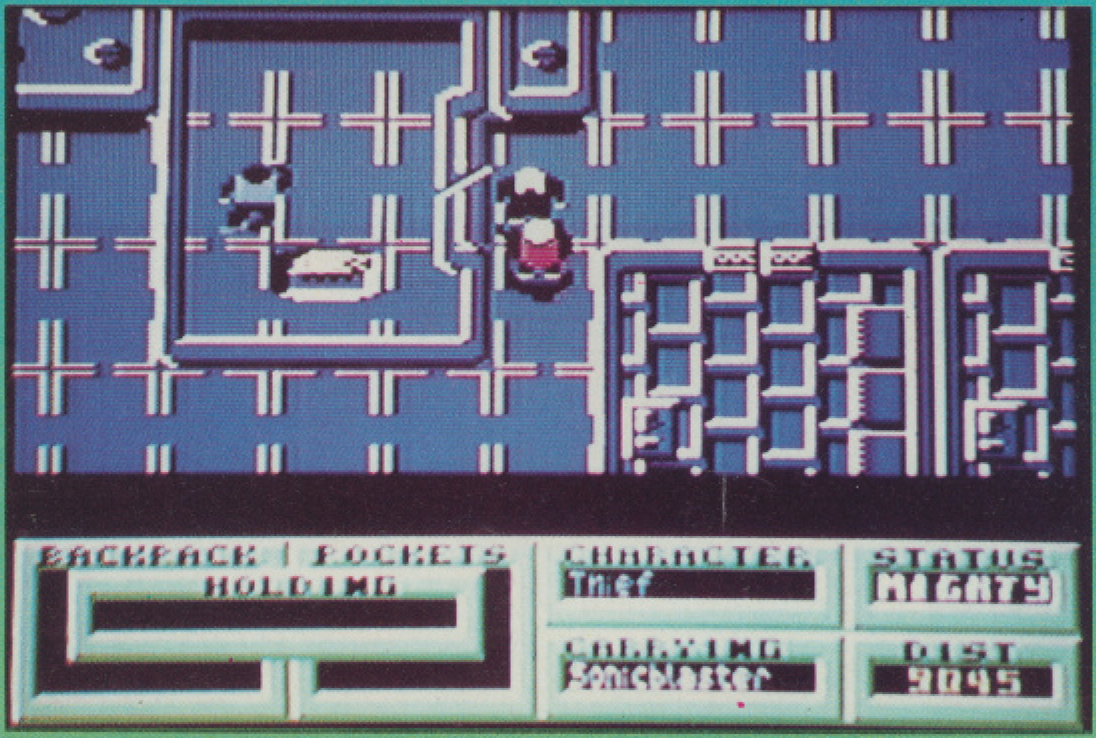
```
SY 53003
```

This will work *without* the machine crashing! Now, with the HIV diverted, our little heart will remain on screen. Set the HIV back to normal again, and the heart can be cleared at ease.

However, we want to do something a tinge more impressive than that, so we'll be looking at using some background music to play our songs for us next time. See you then!

See listings on page 74.

Pandora



Years and years ago the generation ship Pandora was sent out with a crew of droids and men to search out intelligent alien life. Now it is returning to Earth and your mission as a salvage agent is to find out why.

Pandora is without doubt a dangerous place to be, as it is believed to be controlled by a now renegade computer, but it may contain invaluable alien artifacts. In fact your early games could last less than a few seconds, as any attempt to move without a valid ID attracts the attention of the roof lasers, but soon your quest will continue as an entry officer sacrifices himself to give you his ID.

The Pandora is a massive ship and is represented on screen by a scrolling top down display that shows you the ships rooms and corridors as well as the people, security droids and mutants that now populate it. Below this the screen displays what, if anything you're holding and the contents of your pockets or backpack as well as your current health status that can range from mighty, through feeble to dead, the distance to Earth (time left in the game) and the name and equipment carried of any character or critter you meet.

Your first step is survival which means avoiding fights with characters stronger than you are and then making sure you have the right ID at the right time. These ID's are the key to the game and you can find others on the corpses of the crew members. Unfortunately, you can lose them just as easily if the thief catches you, which he usually does, as he hurtles around the ship at high speed. As you approach some characters such as the drunk or the diabetic they'll tell you what they need and if you can solve the puzzle, find the object and return it, you may be able to trade with them for another ID, a weapon, alien artifact or perhaps a means to defeat some of the extra tough aliens that seem to guard the entrances to other sections of the ship.

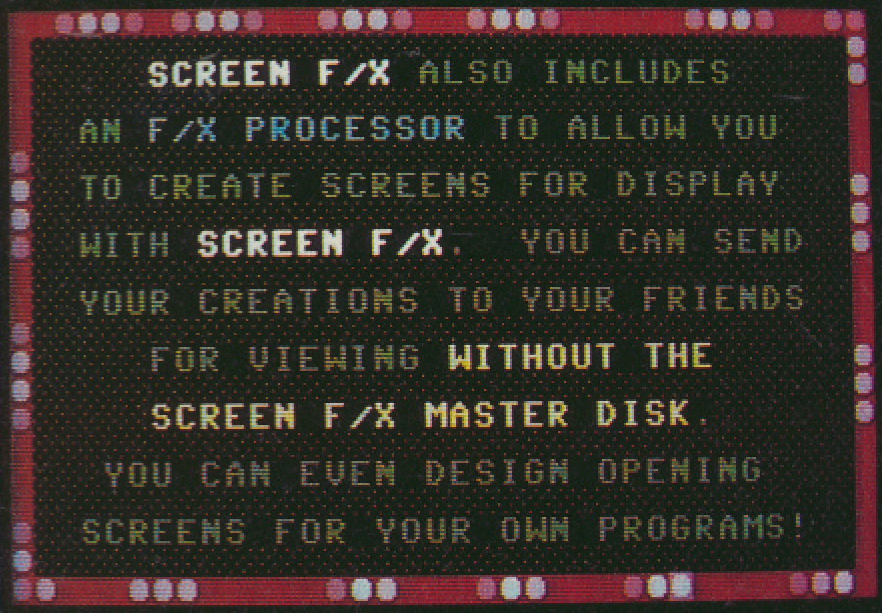
In many rooms you'll also find computer terminals that you can plug into, with the right ID, to learn more about the ship, the crew and the objects you'll find and the aliens you'll trace. For example, apparently the ice creature is susceptible to sound so if you can find a source of sound or the object you'll need to trade for it you might battle your way through to another section of the ship.

Combat occurs whenever you collide with a critter and is decided by a combination of timing and strategy. When a fight begins a bar overlays the object display showing the strength of your adversary and besides that a sliding gauge decides the strength of your hit. If you hit the fire button just before the gauge changes colour the blow strikes your foe with the maximum power of the weapon you're carrying. If your timing is out, the blow is weakened or you miss altogether. Some ranged weapons such as a laser rifle can be fired from range and others are suited to hand to hand combat and either increase the damage you can do or the number of times you can strike.

Pandora is a difficult game to play as the pressure of the time limit causes you to charge around in a loosely controlled panic. Once you've opened the Pandora box and discovered some of its secrets you'll find it difficult to escape.

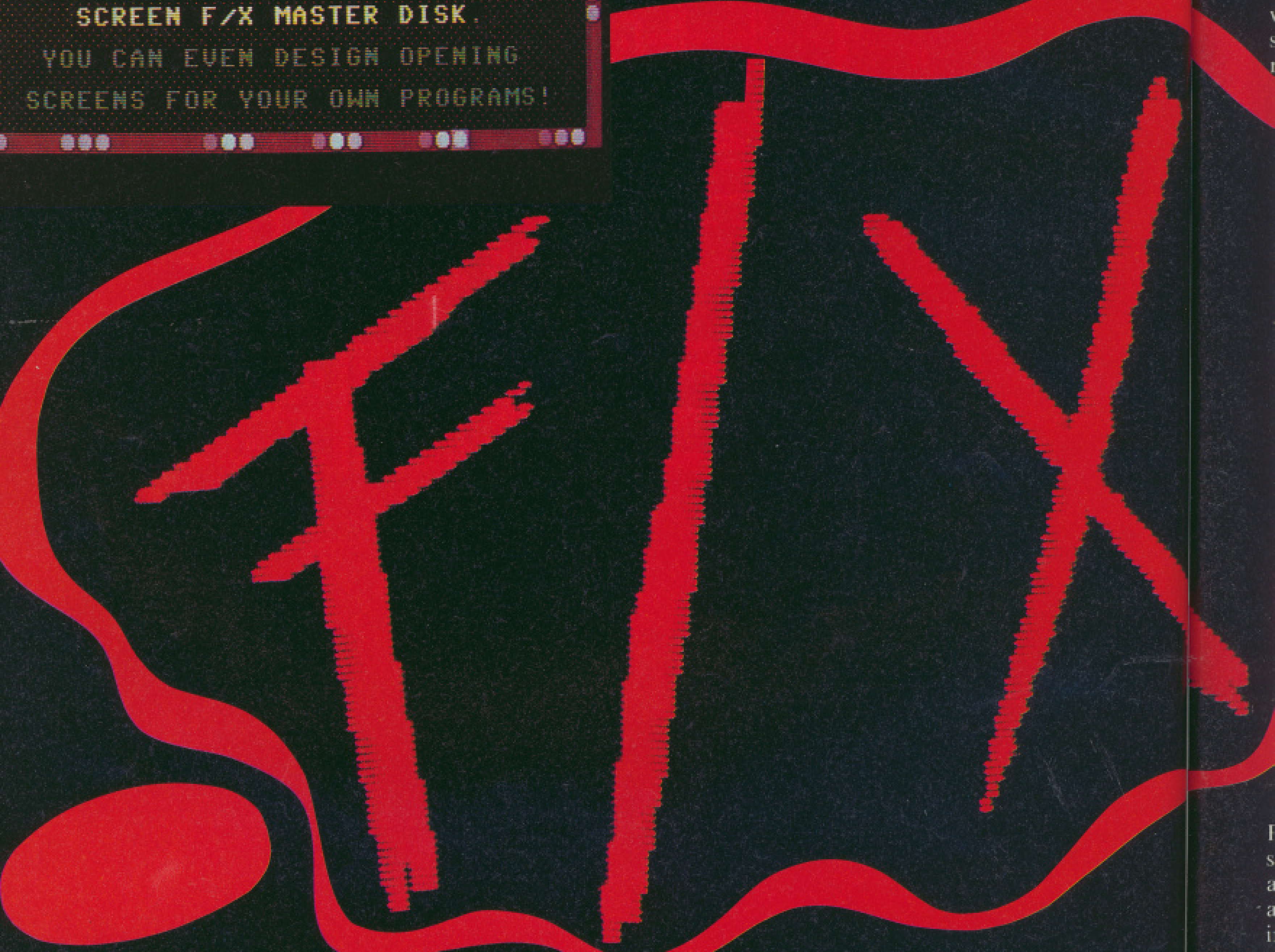
T.H.

Touchline:
Title: *Pandora.* ***Supplier:*** *Firebird, 64-76 New Oxford Street, London WC1A 1PS.* ***Tel:*** *01-379 6755.* ***Machine:*** *C64.* ***Price:***
£8.96 (Ca) £14.95 (Disk).



After spending weeks creating a masterpiece, don't spoil it with an inferior title sequence

By Norman Doyle



Ask any software house about programmers and they'll all tell the same story: the hardest time in getting a program written always comes at the end when the rough edges have to be smoothed down and the program presented in a marketable form. For the programmer all of the challenges have been overcome and the finishing is drudgery. Screen F/X could be the answer because it provides a creative environment which is easily mastered and rewards the user with a wide range of impressive special effect screens.

It's difficult in a written review to do full justice to the range of effects available. Even a photograph lacks the animated effects which makes this program so good; it really does have to be seen to be appreciated.

The main effects are based on the dissolves, cut and wipe techniques used in the television world. Venetian blinds expanding squares, cross corner wipes... you name and it you'll probably find it here. Textured backgrounds or hi-res and multicolour images can be mixed with text, window overlays with shadows can be revealed in a variety of patterns. Menus, multi-window help screens, font changes can all be achieved through an ingenious programming system of option screen menus.

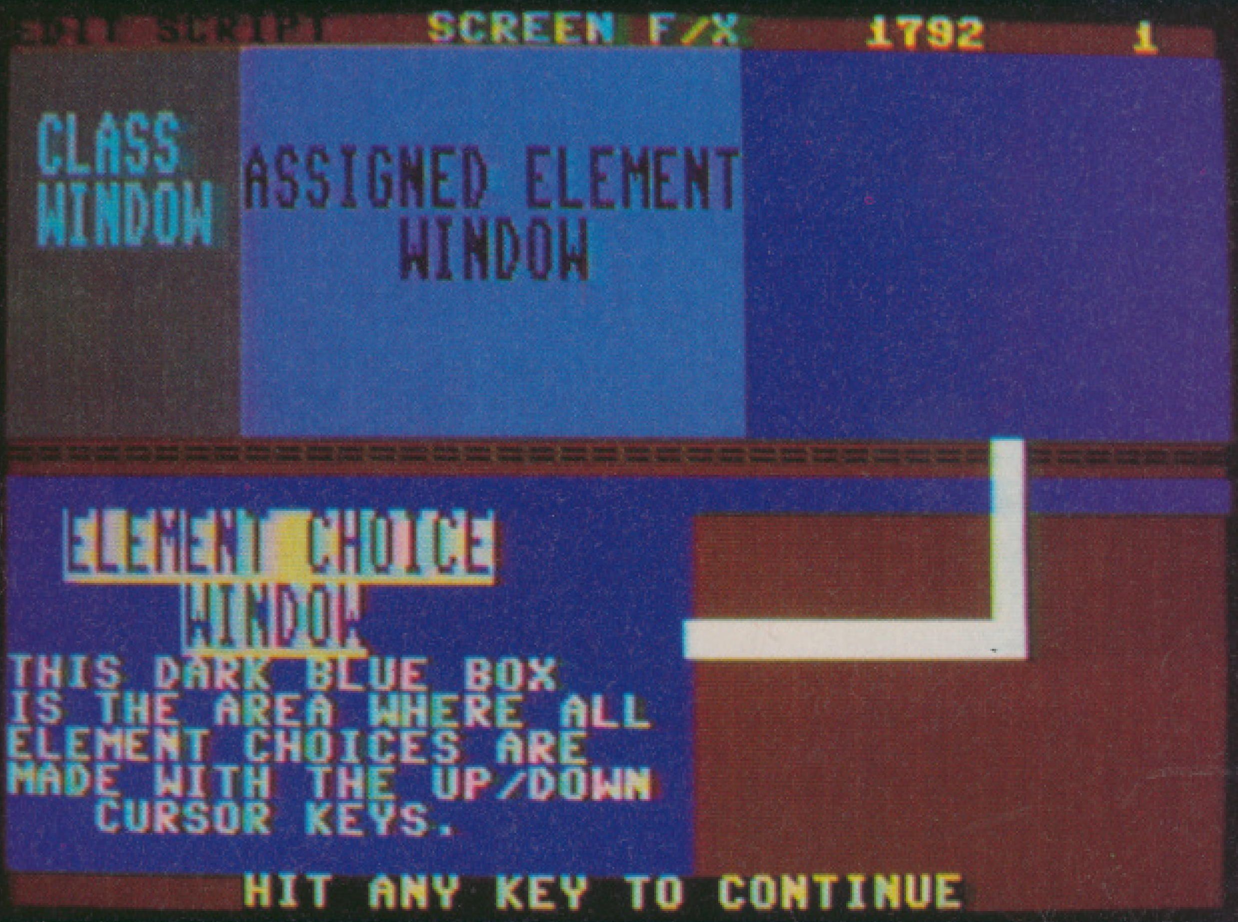
The editing screen is the heart of the program. Here each sequence of events, or 'script', is created by building up a series of effects. The program

ensures that all of the elements are entered by creating a strict regime of sub-menus from which the next step or 'element' within an effect is selected.

The heirachy of script building is to build up several 'elements' into an effect. An element can be transparent, visual or programmed. Transparent elements are passive events such as setting up a background pattern, flipping an image or selecting foreground and background colours. Visual effects are the various types of wipes which involve movement on the screen. This also includes various reveal techniques for displaying text.

Despite the strict programming environment the range of effects are only limited by the user's imagination and the computer's free memory. At each stage the full routine can be run through to check that all is well and any mistakes can then be edited out.

Now for the bad news. The Screen F/X program was written in the USA, therefore it is strictly disk only. Elements of the finished script are loaded when they are needed so an ambitious series of scripts can be slowed down by the 1541 or 1571. The good news is that finished routines will run totally independently



Program effects bring into play a very simple programming language which allows loops to be created to repeat a series of effects, or for getting a user input for menu creation programs.

Altogether these effects can create such scenarios as a text window in one colour and pattern gradually materialising out of an overall background of a different colour and pattern. This effect is rather like the teleport effect on Star Trek. The window can have a border created by superimposing one window on another larger window. The border can then be used by programming a text string to rotate around its perimeter. Then the next screen may appear as though venetian blinds were opening out onto a new world.

of the script editing program.

Also included in the package are three utility programs for manipulating screens and disks. The instructions for the screen manipulation routines are sketchy and require a lot of experimentation to reveal its powers. This program allows hi-res screens to be loaded even though they have been saved from different programs such as Koala, Billboard, Blazing Paddles, Newsroom and Print Shop.

Images can be flipped left to right, turned upside down, cut and pasted to your heart's delight and then saved for use in the next script.

The second utility, Graphix-Link, also involves already prepared images. Images can be changed from one program format to another. A picture saved from the Computer Eye digitiser can be rendered suitable for loading into Blazing Paddles for further manipulation. This is all very nice but some of the popular British sourced graphics programs, like CRL's Image System and Advanced OCP Art Studio from Rainbird, are not supported.

The final utility is one which formats storage disks and copies files for preparing your script disks.

This is a novel program which could be the answer to many a prayer but serious programmers may prefer to use it as an ideas development program. Once the on-screen choreography has been created and tested, it may be better to write a new routine which will achieve the same effect. This would eliminate the time taken in loading various parts from disk.

Screen F/X opens up a world of effects which could not be easily achieved in any other way. For the professional it's a great eye-opener.

Touchline:
Supplier: *Roger Wagner Publishing Inc.* ***UK Distributer:*** *Financial Systems Software, 2nd Floor, Anbrian House, St. Mary's Street, Worcester WR1 1HA.* ***Tel:*** *0905 611463.*

May I Interrupt?

Games aren't the only programs that use interrupts, utilities can also butt in

By Eric Doyle

In previous installments the power of interrupt programming has been shown as a dodge to get spectacular effects. Some programs are not very spectacular but they are extremely useful as time savers. Printer commands are tedious to type in and execute, and if you turn off the printer the commands have to be sent again.

Using the function keys can ease the tedium but a special program has to be written because the C64 does not cater for these potentially useful devices.

The program outlined here sets immediately accessible commands for an Epson-type printer which operate as soon as the key is touched; in conjunction with the CTRL key, the command can be added to the current screen line when building up a line of Basic or when a directly executed command is needed; or each function key can be tailored to suit your needs.

There are two ways to approach programming the function keys and both are used here. One is to tag a series of commands onto the normal Basic handling routine by directing the CHRGET routine based at $0073 to jump into a special routine sequence before reverting to the normal Basic decoding routine. This means that the return key must be pressed before the command is executed. This is the method used by the first program which services the key redefine and function list facilities.

For sending commands to the printer or the screen via the function keys an interrupt is used so that the keys behave as instantly as any of the other keyboard keys.

Extending Basic

The CHRGET routine takes characters from the input buffer one at a time, checks for a command word and then hands over to the Basic interpreter until the command is complete or an error is found. The routine then hands back to the 'ready for a new input' handler.

To wedge in a command of your own the CHRGET is changed to point to your own routine which can then pull out any new commands which you want to use before passing onto the normal decoding system.

The best way to do this is by selecting commands which start with a different letter to any keywords which Basic has already defined and for this purpose the '@' symbol is often used as a prefix. For our purposes using the K for key as our search character means thar no Basic words will be skipped because none of the standard Basic keywords start with K.

The CHRGET routine normally looks like this:

```
INC $7A
BNE $0079
INC $7B
LDA $0200
CMP # $3A
BCS $008A
CMP  $20
BEQ $0073
SEC
SBC # $30
SEC
SBC # $D0
RTS
```

To interrupt the execution of this routine a JMP $C000 command is poked in just after the LDA $0200, but the rest of the routine must be called from our wedged routine at $C000.

Why Interrupt?

The commands stored on the function keys are hidden under the Basic RAM to save on programming space. Therefore each command can be 80 characters long. If the redefine function is not required it need not be loaded. Another code routine can then be stored in $C000 because the interrupt routine is booted from $02BC.

After the interrupt is set the routine switches out Basic ready to service a keypress. If a function key is pressed

May I Interrupt?

the printer file is opened, a string is sent out and the file is then closed.

If the CTRL key is pressed at the same time as the function key the routine jumps to the relevent print to screen routine and the command chain is printed to the current screen line. If this line starts with a program line number the command will be concatenated onto the line when return is pressed. If no line number exists you'll have to make sure that F2 has been pressed to open the printer file output.

The commands held on each key at initialise are shown in Table 1.

The commands for listing and redefining the keys use a special syntax. Key contents can be displayed using KEYLIST and the command held on a particular key can be changed by using KEYx=codes where x is the actual key number.

On its own KEY1 would simply erase the key contents but this would not happen if a string of characters is separated by commas. For example, if F8 was accidentally erased it could be reinstated by KEY8=27,64. If you want to use the keys for purposes other than printer commands they can be defined as print to screen commands simply be enclosing the command chain with inverted commas. In this case KEY8="DATA" would print DATA on the current screen line followed by a space.

TABLE 1

F1	Set NLQ with proportional spacing CHR$(27)CHR$(66)CHR$(4)CHR$(27)CHR$(112)CHR$(1)
F2	Print OPEN4,4: to the screen
F3	Set left margin CHR$(27)CHR$(77)CHR$(40)
F4	Set right margin CHR$(27)CHR$(81)CHR$(38)
F5	Set page length and top/bottom margins CHR$(27)CHR$(67)CHR$(65)CHR$(27)CHR$(82)CHR$(3) CHR$(27)CHR$(78)CHR$(3)
F6	Set condensed pitch CHR$(27)CHR$(66)CHR$(3)
F7	Set subscript and line spacing for mini-printouts CHR$(27)CHR$(83)CHR$(49)CHR$(27)CHR$(65)CHR$(12)
F8	Reset printer to default values CHR$(27)CHR$(64)

See listings on page 74.

The program is typical of many interrupt-driven action key routines. With suitable modification any key pressed with the CTRL key can have added functions just as the SHIFTed or Commodore key shifted keys produce graphic characters.

A disassembler residing in computer memory has to be relocatable if it is to be of any real use. If the program under scrutiny and the disassembler locations clash, one will overwrite the other.

Another occasion when a clash of interests occurs is when a routine uses autorun by loading through zero page locations. Few disassemblers can cope with this and a relocatable loading command is required to pull the program into a different part of memory. The problem with such a method is that the memory locations are changed to those relating to the new location.

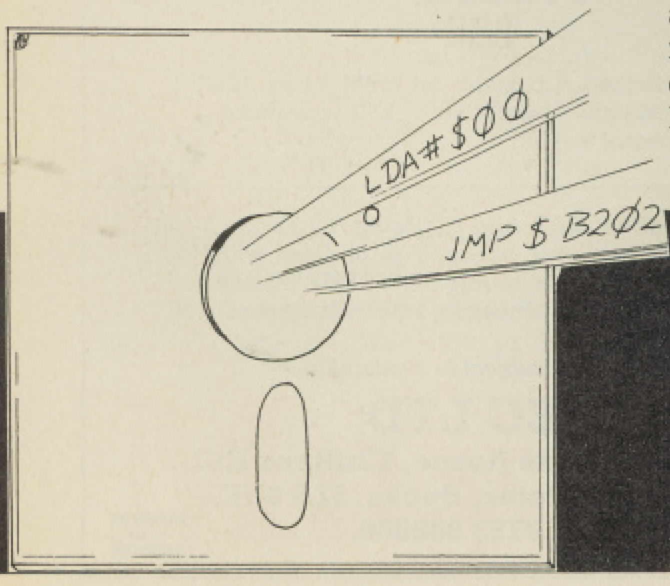
A disassembler which works direct from disk has none of these problems. It can even work with files which are stored as sequential or relative files.

This version of disk assembler lacks some of the facilities of a sophisticated disassembler but will develop its powers in future issues of *Your Commodore*. Commands such as string searches and replacement printer dumps and specific track and sector (T&S) manipulations are already in the pipeline but if you write your own routines or have any suggestions for a specific function or modification that you'd like to see, please write to me at the magazine's editorial address. Do not try to phone me because I'm rarely in the office these days but don't tell the editor, I don't think he's noticed yet!

The Functions

The main requirements of a disassembler is to be able to select a file on disk and see it as a mnemonic code or as an ASCII dump. Diskassembler allows this and more.

For a normal disassembly select a name and the monitor will open the file ready for your next command.



The commands available are shown in Table 1. I've deliberately kept the commands simple so that the structure of the program can be studied. In future issues extra commands will be added which will extend the usefulness of the Diskassembler. Selective track and sector (T&S) disassembly, sector modification and disassembly from a specified memory location are all possible with very little modification to the basic program.

Table 1 — Diskassembler commands

$	display directory
L"filename"	select a program for disassembly
D	disassemble code

The directory command, $, is straightforward in its use. Type it in and press return and the current directory will be printed direct to the screen so that a program name can be selected.

L"filename" will store the relevant data to open the file ready for use with the other commands.

D will disassemble code from the beginning of the file. As each new sector is accessed the block is stored between $C000 and $C0FF. The first two memory locations are a pointer to the next track and sector and are stored in the next available memory locations in the reserved $C100 to $C2FF area so that a complete T&S record for the file is kept for future program modifications.

The next two bytes of the first block indicates the start location for loading the program into memory. These values are stored at $FA for two reasons. Firstly, it gives the disassembler the first memory location for printing out the disassembly but, when the selective disassembly unit is added later, it also gives the base value from which T&S disassembly can be calculated given a specific memory lcoation or track and sector.

The program then enters the disassembly section. The first data value is taken from location $C004 and evaluated by searching through a table. Since memory saving techniques are not required the table is a full one for all code values. The codes are stored in a special way to facilitate counting through to the value of the required byte. The method is analogous to the method employed by the Basic ROM in the C64 when searching for a keyword token. The mnemonic word is stored in normal ASCII values except for the last character which is the ASCII value plus $80. This means that the X register can be used as a counter.

Reading up through the table, each character is examined to see if the seventh bit is set. As this is also the sign bit it means that a BPL command can be applied to increment memory pointers and continue reading. If a character has a set seventh bit it indicates a negative value and the X register is increased by one, compared to the required value and the program then either continues the search or returns to the printout handler according to the result.

Each mnemonic is followed by a number which indicates how many bytes are associated with a particular mnemonic. The hex values of the mnemonic are printed next to the memory location and the disassembled code is then added, but before moving on to the next command a special character dump routine is used.

Besides the disassembly there are two columns of characters. These are a substitute for an ASCII and screen code dumping function. The first column takes the code values for that line and prints the ASCII value. If this value is a control code which would disrupt the display, a fullstop is printed instead.

The second column is created by a routine which converts all code values to an equivalent ASCII value which represents the character that would appear if the code was poked directly to a screen location.

Disk

This facility has been included to ease disassembly to the screen. When a block of data is reached it can be visually evaluated without having to drop out of the disassemble function. Future modifications will include both kinds of memory dump but this should suffice for the moment.

Accessing Disk Files

A couple of features in the program deserve explanation. One of the essential functions of the program is the ability to access disk files. This is more involved than in Basic but roughly follows the same rules.

Firstly a file must be opened. To do this three routines are called from the ROM – SETLFS, SETNAM and OPEN.

SETLFS sets the file number, device and secondary address which corresponds with the numbers in the OPEN 15,8,15 style of command in Basic. To use the function the file number is loaded into the accumulator (A), the device number (8) is held in the X register and the Y register carries the secondary address. I always try to make the secondary address the same as the file number because a simple TAY command can be used to load the Y value. It only saves one byte but every little bit helps.

The SETNAM routine is used to send a command or filename to the disk drive. This correlates with the next part of a Basic command: OPEN15,8,15,"I". The command string or filename can be stored at any handy memory location but the system needs to know where.

Before calling SETNAM the length of the filename or command is loaded into A. The low byte of the memory location of the first character of the name is placed in X and Y holds the high byte.

If no filename or command is set it means that the file will just open up a communication channel with the drive ready for a command to be sent.

In this case A is loaded with zero and, because the X and Y values are irrelevant, JSR SETNAM can be OPEN 15,8,15 ready for a later call of the PRINT # "I" type.
of the PRINT "I" type.

To open the file, no parameters have to be set in X and Y so a straight call to the OPEN command can be used.

When addressing a particular open file the X register has to be loaded with an opened file number and a channel opened through the CHKOUT routine for sending to a command to the disk or CHKIN for reading from disk.

If CHKOUT is chosen, a character is loaded into A and CHROUT is called to send it on its way. This process is repeated for each character until the full message has been sent and then CLRCHN is called to free the drive for access through other open files. If this is not done an error will be generated and the program will stop.

To pull something into memory CHRIN is called which will take the next byte from the buffer queue in the drive and store it in A. The character can then be stored in memory with some form of the STA command.

When reading the program refer to Basic commands to see what the various parts are doing. These routines are the key to many disk file manipulations, if you master these, disk utilities become a piece of cake. Even starting from Basic and using SYS calls to these routines can create some very powerful programs.

It All Adds Up

Addition is easy in code. First of all the carry flag is cleared and then ADC can be applied. Clearing the carry is important because the flat is set when the result of an addition equals a value greater than byte maximum, 255. If the carry flag is not cleared and happens to be set the result of the addition will be one higher than expected. Try this:

```
10 READ A: IF A=999 THEN SYS
49152
20 POKE 49152.A: GOTO 10
30 DATA 169.13.20.210.255.56.169.1
40 DATA 105.01.20.210.255.96.999
The disassembly for this is:
LDA # $0D
JSR $FFD2
SEC
LDA # $01
ADC # $01
JSR $FFD2
RTS
```

The first two lines simply send a carriage return to set the cursor at the beginning of the next screen line. With carry set, a value of one is added to the one in the accumulator. The value of the addition is printed to the screen and proves that putting one and one together doesn't always make two. If the 56 in line 30 is changed to 24 (CLC) the routine will give the answer two.

This is useful when incrementing memory pointers. In the Diskassembler program $FC is used as a memory pointer. This means that at one point $FC stores the low byte value and $FD the high byte of the current disassembly point in memory. As more code is disassembled the pointer is increased as follows:

```
CLC
LDA $FC
ADC # $01
STA $FC
LDA $FD
ADC # $00
STA $FD
```

If $FC is equal to 255, adding one will set the carry flag. When the zero is added to $FD the carry flag will increase the value by one, moving the pointer up to the next page of memory. If $FC is at any other value, nothing happens to the value of $FD.

The Diskassembler includes many othe the useful pointers to programming but its main value is its disassembling function.

See listings on page 74. YC

Disassemble files direct from disk

kassembler

By Eric Doyle

Win Superb Graphics Utilities

Spot the differences and you could be the proud owner of five C64 graphics packages to enhance your artistic skills





Well, we've teamed up with Financial Systems Software for this month's competition. The first three correct entries picked out of the hat will receive a graphics package comprising Photo Finish, BillBoard Maker, Icon Factory, Screen F/X and Clipart. Seven runners up will each receive a copy of the popular Screen F/X package (which we reviewed this month). So send your entries in now.

The Rules

Entries will not be accepted from employees of Argus Specialist Publications and Financial Systems Software. This restriction also applies to employees' families and agents of the companies.

The How to Enter section forms part of the rules. The Editor's decision is final and no correspondence will be entered into.

How to Enter

Study the two cartoons on this page: there are a number of differences between them. Once you have decided how many differences there are, complete the entry coupon and send it to the editorial address (see coupon). Write the number of differences that you have found on the back of the envelope. If you don't your entry will not be accepted.

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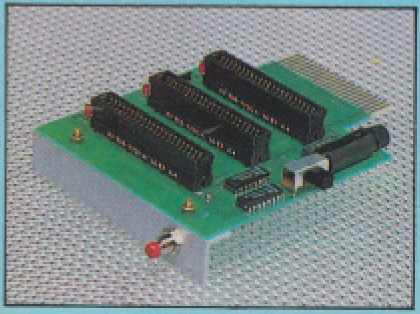
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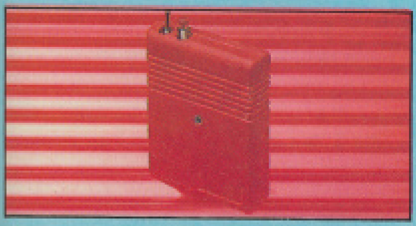
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Now you can have an 8K or 32K cartridge that you program like RAM then acts like ROM!

❑ 8K or 32K pseudo ROM.
❑ Battery backed to last up to 5 years (lithium battery).
❑ Simply load the program you require – then flick the switch. The cartridge can then be removed just like a ROM cartridge.
❑ Make your own cartridges including autostart types – without an EPROM burner.
❑ Can be switched on or off board via software.
❑ I/O 2 slot open for special programming techniques.
❑ 32K version has 4 x 8K pages.
❑ Some knowledge of M/C is helpful – but full instruction are provided.

8K VERSION £14.99
32K VERSION £29.99

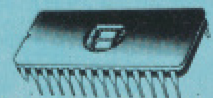
SMARTCART UTILITIES

A series of utility programs for use with Smartcart. Simply load in the program and you have a powerful cartridge. When you have a different requirement – load in another program and you have a new cartridge. The process takes seconds, and can be repeated any number of times.

We intend to release a range of programs. The first available are:

DISKMATE II

❑ all the features of Diskmate II (see ad). Loaded in seconds – with full instructions. **ONLY £9.99**



PRINTER IV

Now you can turn your MPS 801 into 4 printers in one!!

❑ Alternative character set ROM – fitted in seconds.
❑ All four sets have true descenders.
❑ 100% compatible with all software.
❑ Descender. ❑ Eclipse.
❑ Scribe. ❑ Future.
❑ Choose any set at the flick of a switch.

"For anyone who uses their printer often this chip is a must. It's quick and easy to use and the end results are impressive" – Your Commodore, Jan 87.

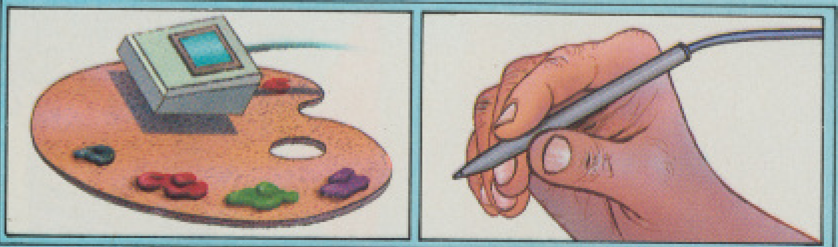
ONLY £19.99



TURBO ROM II

Turbo Rom II is a replacement for the actual kernal inside your 64. It provides superfast load/save routines.

❑ Loads most programs at 5-6 times normal speed.
❑ Saves at 5-6 times normal.
❑ Improved DOS support including 10 sec format.
❑ Programmed function keys:- load, directory, old, etc.
❑ Return to normal kernal at flick of a switch.
❑ FCOPY – 250 block file copier.
❑ FLOAD – special I/O loader.
❑ Plus lots more.
❑ Fitted in minutes – no soldering usually required. (On some 64's the old ROM may have to be desoldered). **ONLY £14.99**



BLAZING PADDLES

A complete lightpen/graphics illustrator package.

❑ A fully icon/menu driven graphics package of a calibre which should cost much more.
❑ Complete with a fibre optical lightpen system for pin point accuracy.
❑ Multi feature software including:
● Range of brushes ● Airbrush ● Rectangle ● Circle ● Rubberbanding ● Lines ● Freehand ● Zoom mode ● Printer dump ● Load/save ● Advanced colour mixing – over 200 hues!! ● Cut and paste allows shapes/windows/pictures to be saved to/from tape/disk.
❑ Blazing Paddles will also work with many other input devices including; Joysticks, Mice, Graphics Tablets, Trackball etc.
❑ Pictures can be saved from Action Replay and edited with Blazing Paddles.

Complete Blazing Paddles & Lightpen **ONLY £24.99**

Blazing Paddles available separately for **£12.99**

TOOLKIT IV

The ultimate disk toolkit for the 1540/1541

❑ A disk toolkit is an absolute must for the serious disk hacker. Toolkit IV has more features than most for less.
❑ DISK DOCTOR V2 – Read and write any track and sector including extra and renumbered tracks. Repair damaged sectors. Look underneath read errors.
❑ HEADER/GAP EDITOR – Decodes and displays ALL header information including off bytes and header gap. Rewrite the entire header and header gap. Renumber sectors. Also edit any sector tail gap.
❑ DISK LOOK – Sort directory. Recover lost files. Display file start/end addresses. Disassemble any file program directly from the disk to SCREEN or PRINTER including undocumented opcodes. Edit Bam. Much, much more.
❑ FILE COMPACTOR – Can compact machine programs by up to 50%. Saves disk space. Compacted programs run as normal.
❑ FAST DISK COPY – Copy an entire disk in 2 minutes or less using single 1541.
❑ FAST FILE COPY – Selective file copy. Works at up to 6 times normal speed.
❑ FORMATTER – 10 second format an entire disk or format any individual track or half track 0 to 41. Redefine any of 30 parameters to create or recreate unique disk formats.
❑ ERROR EDIT – Quickly find and recreate all read errors including extra and renumbered tracks or sectors and half tracks from 0 to 41. Even recreates data under errors and allows you to redefine any necessary parameters.

ONLY £9.99

RAM DISK

❑ Turn your Smart Cart into a 32K RAM/disk.
❑ 32K of instant storage area for files/programs.
❑ Load/save instantly.
❑ Disk type commands: load, save, directory, scratch.
❑ Program data retained when computer is switched off!
❑ Full command set with instructions. **ONLY £9.99**



DIGITAL SOUND SAMPLER

❑ The new sampler allows you to record any sound digitally into memory and then replay it with astounding effects.
❑ Playback forwards/backwards with echo/reverb/ring modulation etc.
❑ Now with full sound editing module to produce outstanding effects.
❑ Full 8 bit D to A and ADC conversion.
❑ MIDI compatible with suitable interface. (I.e. Datel unit for £29.99, see ad).
❑ Live effects menu includes real time display of waveforms.
❑ Line in/mic in/line out/feedback controls.
❑ Powerful sequencer with editing features.
❑ Load/save sample.
❑ Up to 8 samples in memory at one time.
❑ Tape or disk (please state).
❑ Complete software/hardware package **£49.99**
❑ Com-Drum software is available separately at **£9.99** to turn your Sampler II into a Com-Drum system as well as a sampling system.



COM-DRUM

Digital Drum System

❑ Now you can turn your computer into a digital drum system. ❑ Hardware/software package.
❑ 8 digital drum sounds in memory at one time.
❑ Complete with 3 drum kits.
❑ Real drum sounds – not synthesised.
❑ Create superb drum rhythms with real and step time. ❑ Full editing. ❑ Menu driven.
❑ Output to hi-fi or through tv speaker.
❑ Load/save facilities.

ONLY £29.99 (state tape or disk)

COM-DRUM EDITOR

❑ 24 drum sounds supplied on disk to enable you to construct your own drum kit.
❑ Re-arrange sounds supplied with a Com-Drum to make new kits.
❑ With sound sampler hardware you can record your own kits. ❑ Load/save facilities.

ONLY £4.99 disk only

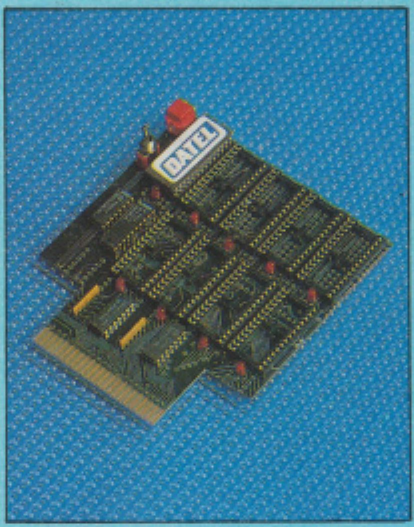
ROBOTEK 64

Model & Robot Control made easy

❑ Robotek 64 is a comprehensive hardware/software package which enables you to connect your 64/128 to the outside world.
❑ 4 output channels – each with onboard relay
❑ 4 input channels – each fully buffered TTL level sensing.
❑ Analogue input with full 8 bit conversion.
❑ Voice input for voice control.
❑ Software features:- test mode/analogue measurement/voice activate/digital readout etc.
❑ Excellent value! **ONLY £39.99** including hardware/software/mic etc. (State tape or disk)

DATEL ELECTRONICS

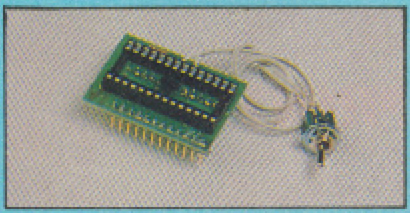
256K SUPEROM EXPANDER



- Now you can select from any of 8 32K EPROMs instantly.
- 8 sockets to accept upto a 32K EPROM in each.
- On board operating system – no programs to load.
- Program your own EPROMs using our EPROM programmer.
- No need to have loads of cartridges – just make a selection from the Superom menu.
- Directory of utilities on power up.
- Fully menu driven on power up.
- Select any slot under software controls.
- Unique EPROM generator feature will take your own programs – basic or m/c and turn them into autostart EPROMs. (EPROM burner required).
- Accepts 2764/27128/27256 EPROMs.
- On board unstoppable reset.

ONLY £29.99

4 WAY KERNAL BOARD

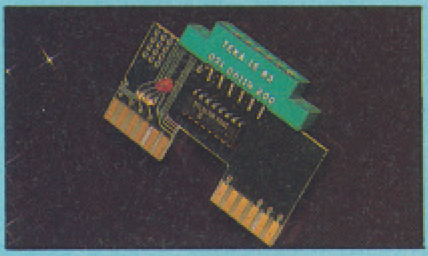


- This board fits in place of the kernal in your 64 and accepts a 16K or 32K replacement kernal giving 2 or 4 different operating systems.
- Just flick the switch supplied to select between systems.
- This is a carrier only – ready to accept your own chip.
- Now you can have all your different systems available at one time.

ONLY £8.99

6 WAY BOARD **ONLY £12.99**

CLONEMASTER™



- Makes tape to tape back-ups.
- Works with even Turbo Loaders etc.
- Requires access to two CBM type data recorders.
- Makes perfect copies.
- Very simple to use.
- LED level indicator.

ONLY £9.99 POST FREE

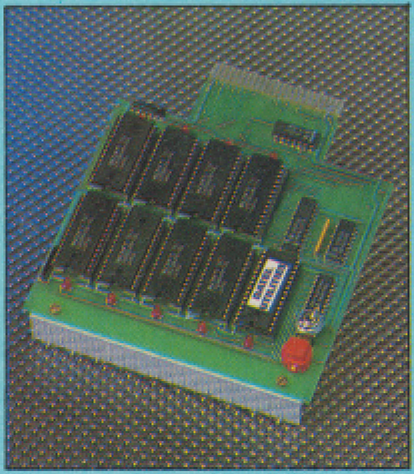
RESET CARTRIDGE



- Unstoppable reset button.
- Resets even so called "unstoppable" programs.
- Add pokes from magazines etc.
- Fits in cartridge port.
- Simply plug in.

ONLY £5.99

DUPLIKATOR™



- Copies whole disk in one pass – only one drive required!
- Makes back-up copies in eight seconds!!
- Duplikator is the fastest, most efficient and easiest to use disk copying system ever conceived.
- Comes complete with 256K on-board ram and it's own operating system – no software to load.
- Makes multiple copies from one original.
- Full disk verification during back-up process.
- Copies standard software as well as errors 21-29 and upto 40 tracks.
- Full disk error check in eight seconds.
- Full disk verify against ram in fifteen seconds.
- A must for clubs, user groups etc. How else can you copy over 250 disks and hour for less than £100.
- Comes complete with on/off switch and reset button.
- Fitted in minutes – no soldering usually required.

ONLY £89.99

DEEP SCAN BURST NIBBLER™



- The most powerful disk nibbler available anywhere, at any price!
- Burst Nibbler is actually a two part system – a software package **and** a parallel cable to connect the 1541/1570/1571 to 64/128 (state type).
- What gives Burst Nibbler its power? Conventional nibblers have to decode the data from the disk before it can transfer it using the serial bus – when non standard data is encountered they are beat. Burst Nibbler transfers data as raw GCR code via the parallel cable without the need to decode it so you get a perfect copy of the original.

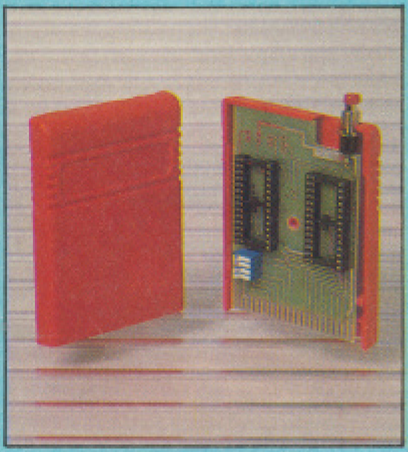
● Will nibble upto 41 tracks. ● Copy a whole disk in under 2 minutes. ● Full instructions. ● Regular updates – we always ship the latest. ● Fitted in minutes – no soldering usually required. ● Full or ½ tracks. ● No need to buy parallel cable if you have Disk Demon/Dolphin etc. ● Cable has throughbus extension for other add ons.

- Whether to choose FastHack'em or Burst Nibbler? Fast Hack'Em is unbeatable value as an "all-rounder" – with nibblers, 1 or 2 drive copy, format, file copy, 1571 copy etc. etc., so if you have a more general requirement perhaps FastHack'Em is for you. Burst Nibbler is a pure nibbler second to none, for the reasons stated. So if it's just making backups you are interested in, there is no other product to beat it.

ONLY £24.99 COMPLETE

SOFTWARE ONLY £12.99 CABLE ONLY £14.99

16K EPROM BOARD



- Accepts 2 x 8K EPROMs.
- Switchable to configure as 2 x 8K or 16K or off.
- On board unstoppable reset.
- Full instructions.

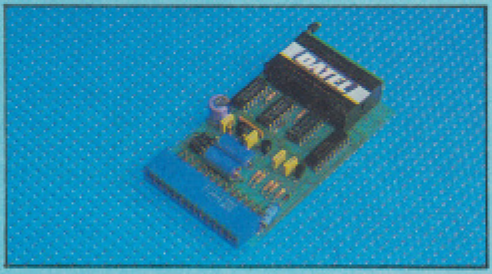
ONLY £8.99

DISK NOTCHER

- Quickly and easily double your disk capacity.
- Use both sides of your disks.
- Simple to use.
- Takes seconds.

ONLY £4.99

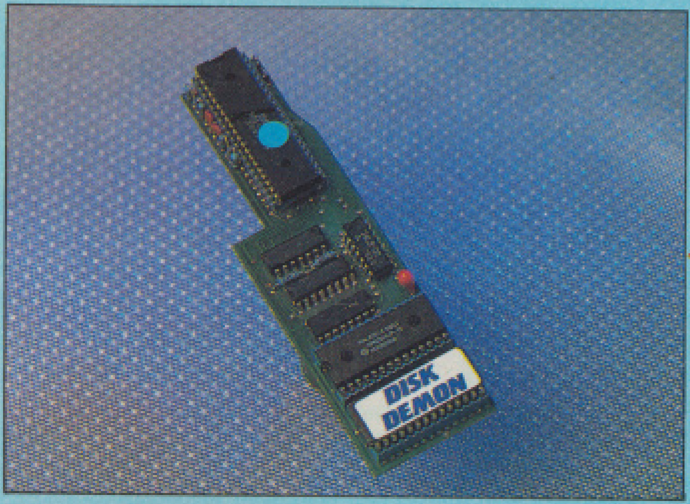
EPROMMER 64™



- A top quality, easy-to-use EPROM programmer for the 64/128.
- Fully menu driven software/hardware package makes programming/reading/verifying/copying EPROMs simplicity itself.
- Will program 2716, 2732, 2764, 27128 and 27256 chips. 12.5, 21 or 25 volts.
- Fits into user port for maximum compatibility with cartridges/Superom Board etc.
- Full feature system – all functions covered including device check/verify.
- We believe Eprommer 64 is the most comprehensive, most friendly and best value for money programmer available for the 64/128.
- Ideal companion for Superom Board, Cartridge Development System, our kernal expanders or indeed any EPROM base project.
- Comes complete with instructions – plus the cartridge handbook.

ONLY £39.99 COMPLETE

DATEL ELECTRONICS



PROFESSIONAL DOS ® MIKROTRONIC

£64.99 POST FREE with Disc Demon operating system

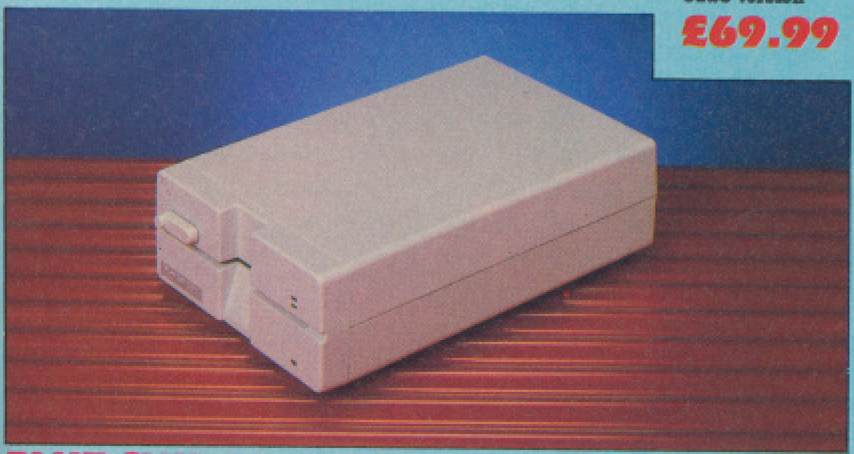
"The world's fastest parallel operating system"

- ❑ Loads a typical 202 block program file in under 3 seconds!
- ❑ 60x faster load (PRG files).
- ❑ 25x faster load (SEQ files).
- ❑ 20x faster save (PRG files).
- ❑ 20x faster save (SEQ files).

PLUS AN ADVANCED COMMAND STRUCTURE INCLUDING:

- ❑ Fast format – up to 40 tracks (749 blocks).
- ❑ 16 function keys: list, run, load, directory, format, save, old, verify, etc.
- ❑ Fload will fastload files up to 250 blocks (other similar systems will only cope with 202 blocks).
- ❑ Number conversion. ❑ Reset.
- ❑ Unique built in file copier will copy files up to 250 blocks like lightning – multiple copy options – perfect for copying Action Replay files.
- ❑ Highly compatible with commercial software – can be switched out for non compatible programs.
- ❑ Perfect for use with Action Replay 3 – a typical AR3 backup will reload in about 3 seconds – yes 3 seconds!
- ❑ Speeds up other DOS functions including verify, scratch etc.
- ❑ Comes complete with superfast file and whole disk copier free!
- ❑ Screen on or off during loading.
- ❑ Enhanced command set – over 30 new commands.
- ❑ Easily fitted – Disk Demon plugs inside the 1541 and the new operating system chip plugs inside the C64/128. Fitting takes only minutes and usually requires no soldering.
- ❑ User port throughbus supplied free – you could pay £15.00 for this alone.
- ❑ Supplied complete – no more to buy.
- ❑ Works on C128/1541 in 64 or 128 mode.

C128 version £69.99



BLUE CHIP DRIVE

● **Fully C64/128 compatible.**

- ❑ At last a top quality drive at a sensible price.
- ❑ Super slimline case
- ❑ External power supply for cool operation.
- ❑ Direct drive motor.
- ❑ Supplied complete with all cables – no more to buy.
- ❑ This drive is now probably the most compatible drive available for the Commodore. More so than even Commodores own '1541C. Much more so than other so called compatibles. In fact we have been unable to find a program including the latest that would not work. (At time of Press).
- ❑ **No need to look elsewhere – this is the best.**

ONLY £139.99 POST FREE
(If you require courier delivery add £5.00).

ULTRA CRUNCHER

● **The ultimate cartridge based program compactor.**

- ❑ Compacts by upto 30%!
- ❑ More programs for disk.
- ❑ 3 compacting programs on one cartridge.
- ❑ Fast loading/saving routines – works with Disc Demon.
- ❑ Can even further compact AR III files!
- ❑ 250 block file copy function.
- ❑ Full DOS support including fast format.

ONLY £12.99 on cartridge. Available as chip only for 256K Superom Board for only £7.99

FAST HACK'EM ™

● **Multi Module Disk Nibbler – all on one disk.**

- ❑ Single 1541 Nibbler – Copy a disk in 2 minutes.
- ❑ Auto Nibbler – Copy an entire protected disk in 3 minutes.
- ❑ Super fast File Copy – Under 9 seconds typically.
- ❑ Copes with Fat Tracks.
- ❑ Superfast Copy – Entire disk in 36 seconds with verify.
- ❑ Twin Drive Copier – Even faster!
- ❑ Plus unique "Parameters" mode. These files "Unlock" the more heavily protected programs with a parameter for a particular brand or even single program.
- ❑ **No other product is such a good "All Rounder" at this price its unbeatable.**

ONLY £9.99 POST FREE

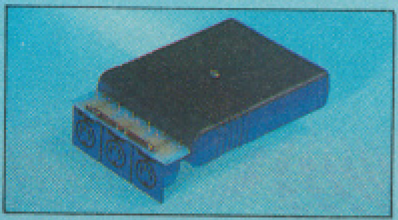


DISKMATE II

The Disk Utility Cartridge

- ❑ Disk fastload cartridge.
- ❑ Up to 5 times faster.
- ❑ Fast save. ❑ Fast format (10 secs).
- ❑ Improved DOS – single stroke commands – load/save/dir/old etc.
- ❑ Redefined function keys for fast operation of common commands.
- ❑ Powerful toolkit commands including: old/delete/merge/copy/append/autonum/linesave etc.
- ❑ Plus a full machine code monitor – too many features to list but it has them all!
- ❑ Special switching techniques make Diskmate invisible to the system. Therefore it is a more compatible fastloader than other types.
- ❑ Diskmate II is

ONLY £14.99

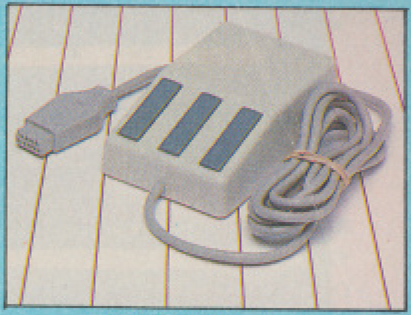


MIDI 64

A Full Midi Interface for the 64/128 at a realistic price

- ❑ MIDI in. ❑ MIDI thru. ❑ 2 x MIDI out.
- ❑ Compatible with most leading software packages including: Seil, JMS, Advanced Music System, Joreth, Steinburg etc.

ONLY £29.99



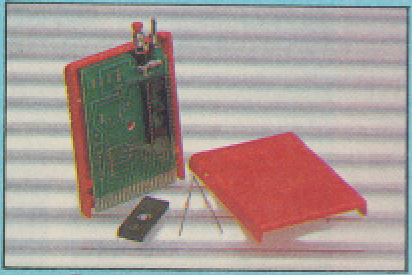
MOUSE

- ❑ CBM 64/128 mouse.
- ❑ Wide compatibility with software including: Blazing Paddles.
- ❑ Works by mimicking joystick so will work in any joystick application including graphic packages only designed for joystick.
- ❑ Functions on either joystick port.
- ❑ Optical system operation.

ONLY £24.99

CHIPS

- ❑ 27128 **£3.00 EACH**
- ❑ 27256 **£4.50 EACH**



CARTRIDGE DEVELOPMENT SYSTEM

- ❑ All the necessary parts to produce an 8K/16K auto-start cartridge.
- ❑ Top quality PCB. ❑ Injection moulded case.
- ❑ Reset switch. ❑ 16K EPROM.
- ❑ "Cartridge Handbook" gives full details and tips on building and configuring the cartridge for many uses.

ONLY £12.99
complete with handbook

ALL ORDERS NORMALLY DESPATCHED WITHIN 48 HRS

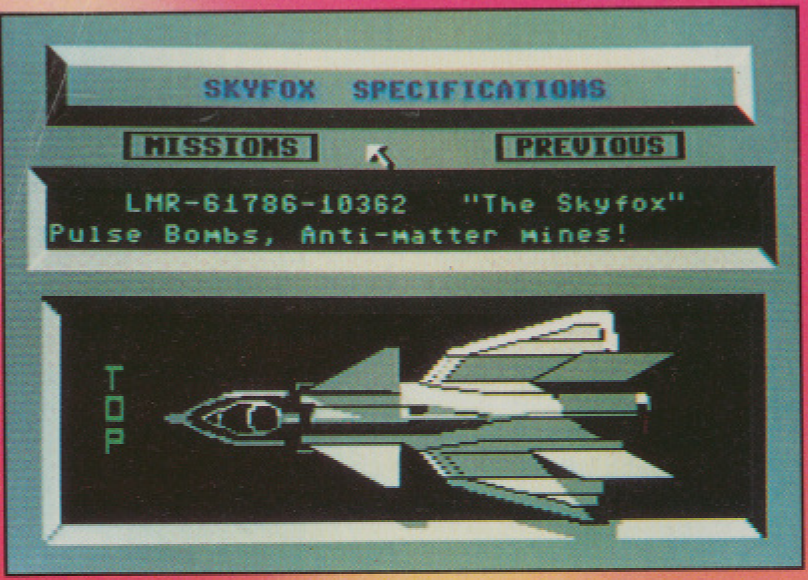
HOW TO ORDER . . . .

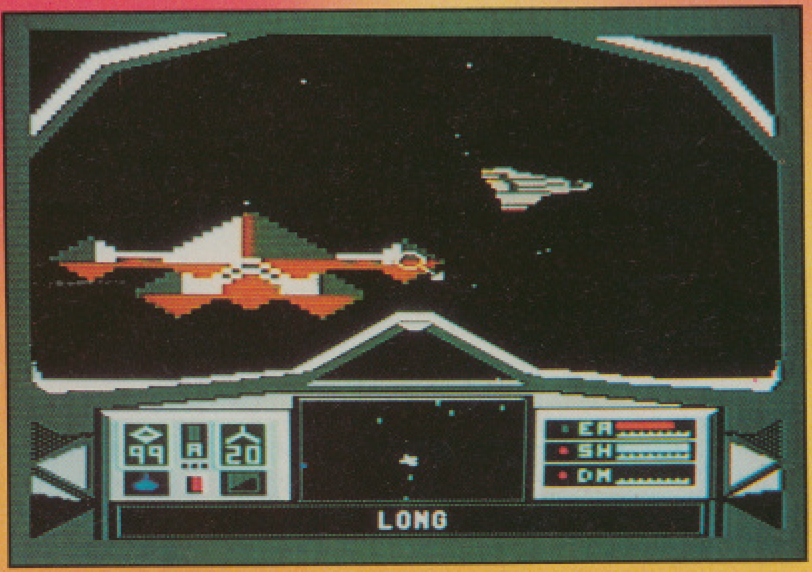
BY PHONE	BY POST	BY PRESTEL/FAX
0782 273815 24 hr Credit Card Line	Send cheques/POs made payable to 'Datel Electronics'	Prestel Pages * 25880000A Fax Orders 0782 264510

DATEL ELECTRONICS

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SALES ONLY	TECHNICAL ONLY
0782 273815	0782 202258





Skyfox II

Sequels it seems are all the rage at the moment. After all, why expend all that mental energy coming up with a new idea that may or may not work, when you can successfully rehash an old title and bask in some of its former glory. Cynicism apart though, the stunningly originally titled Skyfox is a pretty good game in its own right.

Subtitled the Cygnus Conflict, the game is a futuristic combat/flight simulator. You are a member of the elite Federation Warwarriors and, as there are all sorts of rumours knocking about of a Xenomorph uprising, the Federation have been put on condition alert. The general concensus of opinion is that they are seeking total conquest of the Terran Federation.

There are two factors that should prove decisive in the ensuing conflict. First, there is the Skyfox II warfighter with its proven technical superiorority. Secondly, but unproven is your skill at flying the beast.

Becoming the master of your machine is no easy matter and there are ten graded missions for you to select from. These range from minor skirmishes, to protecting ambassadors, destroying deathbases and finally discovering a long lost starbase that may or may not be in friendly hands. Completing (or failing on) a mission will bring up an evaluation screen, showing just how well or badly you did.

Your ship is a tricky little beast to get to grips with, involving as it does a combination of joystick and keyboard controls. There is a head up display (HUD) on the windscreen of your cockpit, but it gives only limited information as to the range and direction of a potential target. You still have to refer to your instrument panel to discover if the craft is friend or foe.

An overview of the surrounding star systems can be called up and you can select whatever heading you require. There is an autopilot function to take the hassle out of navigation but – and there is always a but – the autopilot takes you to your destination by the most direct route. This unfortunately does not take into account any of the hundreds of asteroids that are likely to lie between you and your target. This gives you the option of flying round them manually or blasting the unwanted bits of space debris away with your photon pulse bombs. Collision with one of the asteroids is likely to seriously damage one of your ship's computer systems.

A short cut through the ether of space is sometimes available to you in the form of wormholes. These by-products of black holes act as tunnels taking you vast distances in a matter of seconds. They are marked on the map that accompanies the packaging, but the colour scheme chosen (dark grey on black to avoid photocopying) renders them almost invisible under daylight conditions and totally invisible under artificial light.

As well as your photon bombs, you also have a neutron disruptor laser and a supply of anti-matter mines. A deceptor device renders you invisible to the enemy but at the cost of large amounts of energy. Energy and weapons can be replenished by docking at a friendly space station. Keep an eye on your radar though as it may be necessary to resume battle with a partially repaired ship.

Graphically, I found the game disappointing. The colours are fairly dull, being largely greys and blacks and the interior of the cockpit is sparse. A few flashing lights and extra control panels, even if they had no function within the game itself could have added to the appearance. Even the explosions when you are blasting meteors are muted and there are a few sprite problems here as well.

The gameplay works well though if not quite as good as the original and anyone who enjoys the combination of flight simulators and shoot 'em-ups will find that they have a fair old challenge on their hands. **G.R.H.**

Touchline:

Title: *Skyfox II.* ***Supplier:*** *Electronic Arts, Langley Business Centre, 11-49 Station Road, Langley, Nr. Slough, Berks SL3 7YN.* ***Tel:*** *0753 49442.* ***Price:*** *£14.95 – disk only.*

Books

Fed up with the keyboard and feel like a read? Watch this space for interesting publications

COMPUTER AIDED DESIGN

Well I've got good news and bad news. The good news is that this book covers computer aided design (CAD) for both the C64 and the C128. The bad news is that C64 owners will need a Simon's Basic cartridge to get any use from the numerous listings and the book assumes that you own a disk drive.

CAD systems has been the buzzword in engineering circles for several years now and with each year the systems have become more and more complex. For those new to this term, a CAD system is a tool which can be used to produce standard elevation drawings of a projected new product but the computer allows this to be taken one step further. The design can then be displayed as a 3D object and rotated at will to allow examination from all possible angles.

This book attempts to explain CAD principles while building up a useful CAD utility program. To do this a compromise has been necessary by producing all of the listings in Basic. The result of this is that the finished utility runs slowly and more serious users would soon feel the need for a machine code program.

Each chapter gently takes you deeper into the mysteries of CAD, starting with the basic elements of technical drawing. A certain amount of rudimentary knowledge of the subject is assumed but I don't think this will be beyond most people.

The finished program is a very powerful design tool with many facilities to ease the problems of producing the initial drawings. A grid which can be displayed, used and deleted, the facility to make scale changes and zoom in on detailed areas, mirror imaging, dimension scales and shading provisions and the very essential set of erasing routines are all available. A very impressive range, as I'm sure you'll agree.

Macros are produced for 3D drawings on the well-founded assumption that all shapes can be broken down into a fixed set of elements: cuboids, cylinders, prisms, cones, truncated cones, pyramids and spheres. Once assembled the shapes can be displayed as wire frame, surface or volume models for varying degrees of clarity. Wire frame drawings show all of the lines which form a shape whether normally hidden from view or not. Surface models hide all of the lines which would not normally be visible from a particular perspective. Volume models show hidden lines as dashes and lies somewhere between wire frame and surface models in terms of clarity.

Finally rotational parameters can be set to view your finished drawing in whatever attitude you choose to select.

The book is easy to follow and succeeds in cutting through the jargon laden principles of CAD. The listings are fed in gradually and I have only one small complaint in this area. The author uses a variable I1 which could be mistaken for a double < I' variable and makes debugging tedious.

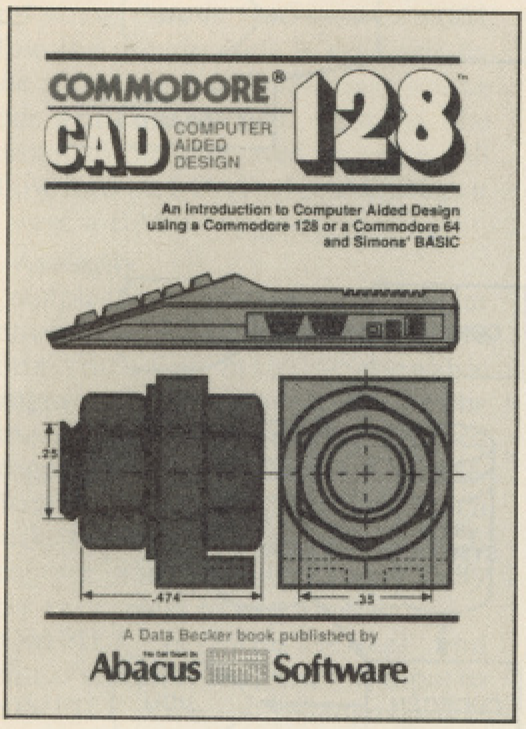
Serious students and those with enquiring minds will be entertained for many happy hours with the contents of this book, and I would rate it as the best I have seen so far on this fascinating subject. **E.D.**

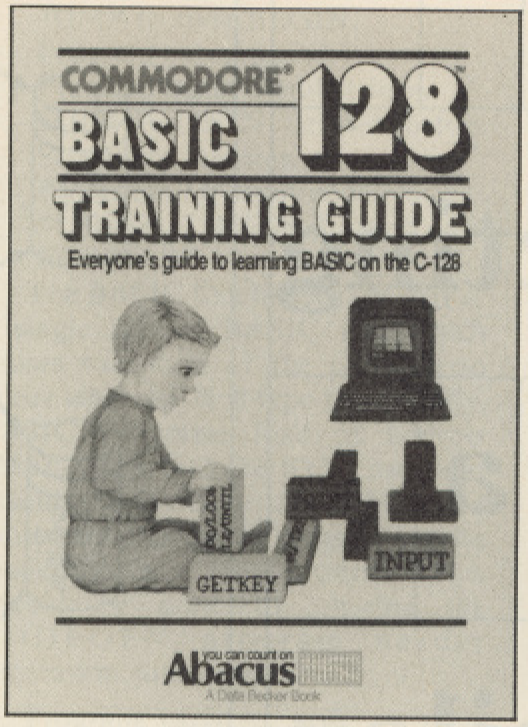
Touchline:
Author: *Werner Heift.* ***Distributor:*** *Precision Software Ltd (Abacus Software).* ***Price:*** *£12.95.*

C128 BASIC TRAINING GUIDE

Tutorials are difficult to recommend on the basis that one man's meat is another man's poison. With so many commands to call upon the order in which a tutor deals with them is fairly arbitrary as long as a thread of logic holds them together.

Kampow starts off logically working through the principles of algorithms on the basis that an organised mind is a logical mind. Then for some reason he plunges into binary, hexadecimal and boolean operators. This is not only confusing for beginners but also unnecessary for most applications. Even some well-known machine code programmers refuse to dabble in hexadecimal unless absolutely forced to.







If you are getting the impression that I dislike this book you're not wholly right. Starting at chapter two the book improves considerably. As each new command is introduced, Kampow turns it around to show the forms it can take.

Several chapters are terminated with a series of exercises based on the information gleaned so far. Unfortunately there are mistakes in the answers to these problems, a serious mistake for something that purports to be a tutorial! One question on variable names asks the reader to decide which variable names are legal and which would not be accepted by the C128. Two 'legal' names are given as WORLD$ and MONDAY, both of which contain reserved words within themselves. A definite syntax error message for this mistake!

After looking at arrays, the principles of file management are given the once over. Here the fact that it is an American edition of a German book causes one or two problems. Because tape recorders are used as doorstops in the States this chapter assumes that everyone owns a disk drive. More than this, it also assumes that those who do not own a 1541 drive must have a double sided 1571 which are not available in the UK.

There are dozens of Basic tutorials in the shops and this is just one of them. It has nothing to offer which can't be found elsewhere and there are several far better tutorials around.

E.D.

Touchline:
***Author:** Frank Kampow. **Distributor:** Precision Software Ltd (Abacus Software). **Price:** £11.95.*

BASIC 7.0 INTERNALS

If you've ever wondered how your C128 copes with Basic then you ought to get a copy of this book as soon as possible. Over 600 pages contain all you could ever wish to know about the internal operations of your machine.

About 500 of these pages are dedicated to a disassembly of the Basic ROM routines. Each section of the disassembly is clearly annotated with an overall description of what the subroutine does and then detail of how this is achieved. If Basic internals turn you on then there's fodder here to keep you browsing for several months.

For me, the greater value of this book is the description of how variables are stored and the stack manipulated when various Basic routines are used.

A detailed comparison of variable types and their storage can help you to realise how time and memory can be saved if you use the correct style of variable in your programs. The thorny subject of floating points variables is tackled bravely but still requires a fair amount of head scratching and thought before the penny finally drops.

There is a lengthy section on RAM expansion module handling which will hold more interest for me if I ever find a source of RAM expansion modules in the UK.

Although C128 Basic is faily full there may be a time when you want to add a new command word and accompanying routine. A whole chapter is dedicated to this subject with an example routine thrown in for good measure, showing how a wedge can be locked into the CHRGET routine for automatic and frequent execution.

Just before the ROM listing there is a section on graphics which not only shows how to switch screen and character memory around, but also shows how Basic graphics routines can be latched into machine code programs. I can't think of a more suitable introduction to justify the inclusion of the ROM breakdown on the next few hundred pages.

This is another excellent book from Abacus for programming devotees with an understanding of machine code. For novices the ROM routines form quite useful examples of program routines but I would not recommend this as a way of teaching yourself machine code.

E.D.

Touchline:
***Author:** Dennis Jarvis/Jim D. Springer. **Distributor:** Precision Software Ltd (Abacus Software). **Price:** £16.95 + £1.40 (p&p).*

Constructing a Compiler

Part two of our series continues the introduction to developing your own compiled programming language **By Steve Carrie**

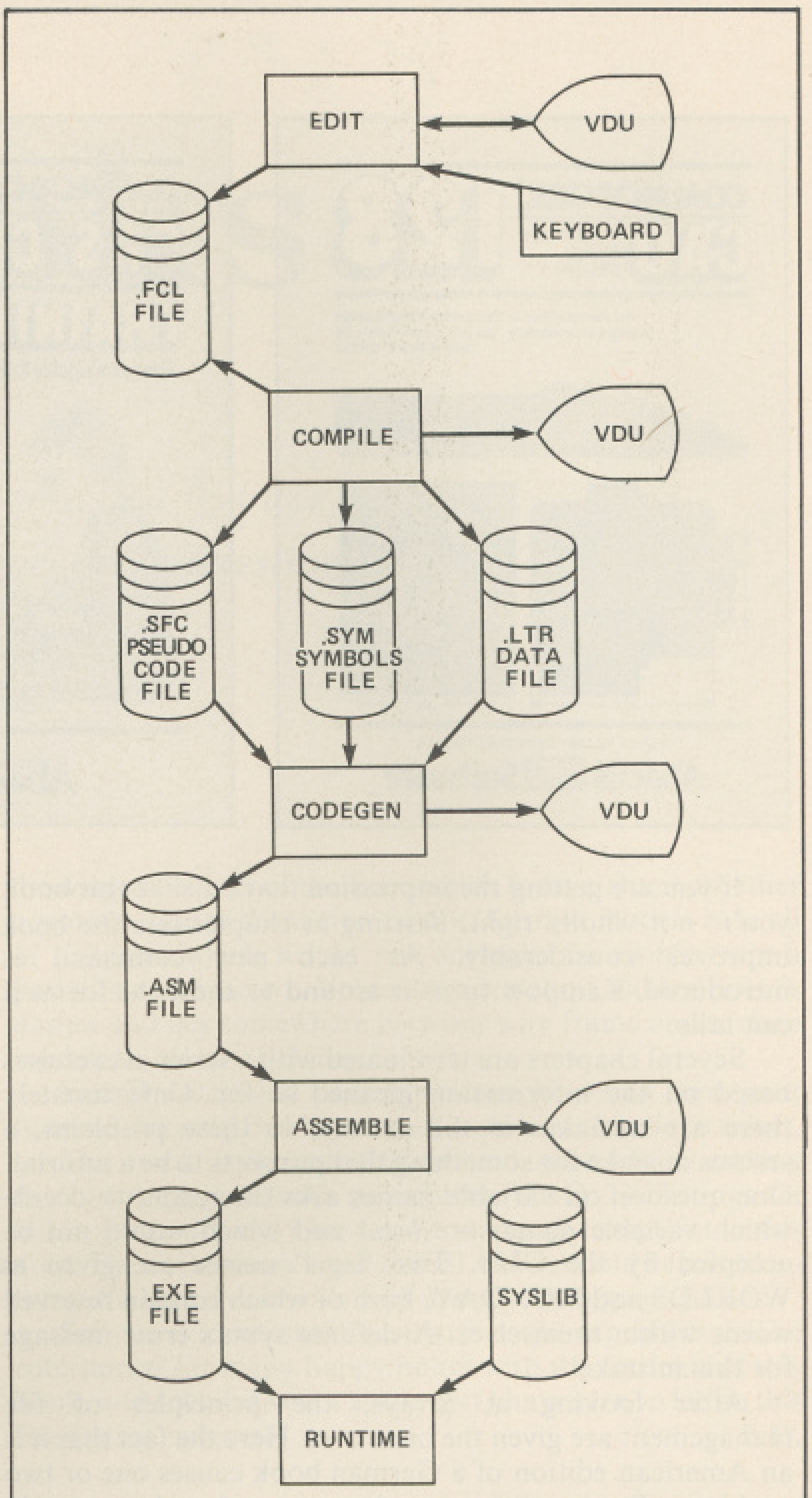


Fig 1 - FCL Compiler system

Here are two example programs. The first requests input to a string array which is then written to a disk file. The second reads the data back from the file and displays it.

The Compilation Process

In this section I will attempt to explain the various stages in the compilation process and how they relate to one another. I will also explain the runtime operation of a compiled FCL program.

The job of translating a source language text into a machine code program is split into a number of stages. These are referred to as analysers since their task is to analyse input data and produce output data or error messages. In the FCL compiler, there are four distinct stages.

- **Lexical Analysis**

A line from the source file (.FCL) is scanned and segmented. These segments are then checked to see if any contain reserved language elements such as function or operator symbols. These are replaced by single-byte "tokens". Subsequent analysers are able to recognise these tokens since they have a numerical value of 128 or greater whereas normal ascii text characters have values of 127 or less.

- **Sybtax/Semantic Analysis**

In some compilers, these two analysis stages are performed separately. In FCL, it was decided to combine them. The segmented and (possibly) tokenised line is obtained from the lexical analyser and a scan initiated from left to right. The syntax of the line is checked and any errors reported. This ensures that the programmer has not included any illegal character or symbol sequences. In addition to syntax error checking, the semantic meaning of the line is also checked and any semantic errors reported. As the scan progresses, a sequence of pseudo-instructions is generated which represents the operations to be carried out. If the line is error-free, this sequence is written to an intermediate disk file (.SFC). When the whole file has been checked and there are no errors, two additional data files are created. These contain symbol (.SYM) and literal string (.LTR) information which will be used during code generation.

- **Code generation**

The three files from the previous stage

are used to produce a single assembly language source file. First, the symbol and string data is read into memory. Now the pseudo code is read line by line and the assembly language source code written to the new .ASM file. The format of the generated program will allow it to be LOADed and RUN as if it were a BASIC program file.

- **Assembly**

A simple two-pass symbolic assembler converts the assembly language source code into a machine-runnable program. This operation is, like the others, file based and the finished program is contained in the .EXE file. There are three program files which work together to compile an FCL program and Fig 1 diagramatically how they relate to one another.

COMPILE performs lexical and syntax/semantic analysis. The input to COMPILE is the source language text file (.FCL) created using the source editor, EDIT. Output from this stage is the .SFC, .SYM and .LTR files.

CODEGEN uses these three files to produce the assembly language source code file (.ASM).

ASSEMBLE is the two-pass symbolic assembler used to produce the final .EXE file.

The story does not end here however. In order for the .EXE runfile to be able to perform the tasks required, it needs a runtime support library. This is the **SYSLIB** file which is loaded by the rununit at initialisation time. SYSLIB provides services such as file handling and basic I/O. SYSLIB also provides a comprehensive run time error checking facility with some 15 to 20 error messages.

It is possible to edit the intermediate .ASM file produced by CODEGEN using EDIT. In this way, you may make changes to the program without re-compiling.

Theory of Runtime Operation

When the runtime file is loaded and executed, the system pointers and data buffers are initialised. The runtime support library SYSLIB is loaded into memory at $C000 and initialised. If no library file is found, the system reports an error and execution is aborted. Execution of the program begins at the Procedure Division BEGIN statement and ends at the corresponding END statement. The structure of the runtime module is determined at code generation time and is as follows:

- BASIC link header section and SYS command.
- SYSLIB library loader.
- JUMP to code BEGIN.
- Program variables.
- Program static literal strings.
- SUBROUTINES defined before Procedure Division.
- Procedure Division code.
- SUBROUTINES defined via FORWARD.

The BASIC link header consists of a single line of BASIC text which causes execution of the program to occur when RUN is typed. Normally, BASIC programs load at address $0801. Note that the SYS command executes the code at this address and must be changed if the program is to be loaded at any other address. This should be done by altering the CODEGEN program header generation subroutine.

Program variables differ in their memory requirements. Scalar integer types require two bytes of storage. For integer arrays, the number of bytes required is twice the number of array elements plus two bytes used by the system. For a string variable, the memory requirement is three bytes (known as a descriptor). The first records the length, the subsequent bytes recording the string's address in memory. String arrays require four bytes per element plus two bytes for the system. These system bytes are used to record the number of elements in the array.

Literal strings are stored as they appear in the source program with an additional byte prefix recording the length of the string. These strings are termed STATIC. The memory left free after the program has loaded is given over to the storage of DYNAMIC strings.

Several zero page memory locations are used by the system at runtime for special pointers and counters which I will call SYSTEM VARIABLES. Numerical operations such as addition and multiplication are carried out using two memory areas called ACCUMULATORS. These are known as AC1 and AC2. In addition to these, two temporary string descriptors, SD1 and SD2 are defined. These are both three bytes in length and have the same format as a normal string descriptor. Two UTILITY POINTERS, UP1 and UP2 are also defined and are used to hold parameters for operations requiring memory addressing. The ARRAY POINTER is another two-byte variable used to address integer or string array elements. TT1 is a two-byte General purpose temporary storage variable.

Many of the tasks undertaken by the system runtime library make use of the aforementioned variables. Even with this much memory put aside the system still requires some other temporary data storage. This is supplied by a runtime "stack" which operates in much the same way as the microprocessor's stack. Data is "pushed" onto the stack or "pulled" from it on a Last-In First-Out (LIFO) basis. For the most part, data stored here is the intermediate results from numeric and string operations. The order and frequency of stack operations is determined by the compiler at the semantic analysis stage. Information to be stacked generally comes from the second accumulator or descriptor, i.e AC2 or SD2. During destacking, the information recovered is placed in the first, i.e AC1 or SD1. Results from operations are returned in AC2 or SD2. Thus, operations which do not convert data types may be represented symbolically by:

[AC1] | AC2 = >AC2 for numeric operations,

[SD1] | SD2 = > SD2 for string operations.

Where | represents some operation. In some cases, AC1 or SD1 is not used (for example in a logical NOT operation) hence the brackets []. For data type conversions, the operations are:

SD2 | = >AC2 for string to numeric,

AC2 | = >SD2 for numeric to string.

The system library maintains the DYNAMIC string storage area using system variable SPTR (string pointer). Unlike BASIC where the string stack grows downward in memory, the FCL stack grows upwards from the end of the program to address $A000. As I stated earlier, there is a problem with string storage due to the lack of garbage collection routines. When SPTR reaches the top of memory at $A000, the program will stop. A garbage collection subroutine should locate valid strings and pack them down into low memory, adjusting SPTR to reflect the new top-of-strings address. Unfortunately, a design flaw made this impossible in the current version, i.e. I'll know better next time.

That completes the description of the compiler system and its language. Next time, I'll present the source text editor program, EDIT, and the first of the four main programs, COMPILE.

Pacland

The clock strikes 6pm and suddenly the Pacland tune escapes from my Commodore – the fact that I have eventually become addicted to a computer game has now worn thin (does she have to play it with the volume right up – anon). Armed with joystick and Diet-Coke (some of us have our figures to consider not like the Amiga 'Cherry-coke' drinking reviewers I could mention!). And so the long awaited sequel to Pacman has arrived in the form of a horizontally scrolling platform game. The aim of the game is quite simple (it would have to be for Sue to play it – WHACK! The cherry coke reviewer tries unsuccessfully to get his revenge).

A fairy has become lost in Pacland and it's up to Pacman to take her back to the far side of the island, through the magic door to Fairyland. Pacman carries the fairy under his hat, fending off his old friends *en route* in the form of Blinky, Pinky, Inky and Clyde.

The first few levels take Pacman through the hazardous Pacland streets where you constantly have to be on the lookout for the ghosts who try to attack in cars and planes dropping bombs which seem to come from all directions – so look out! Beware of travelling too slowly as you're constantly followed by the evil purple ghost who will gobble you up if you lag behind, and one of your valuable five lives will be lost.

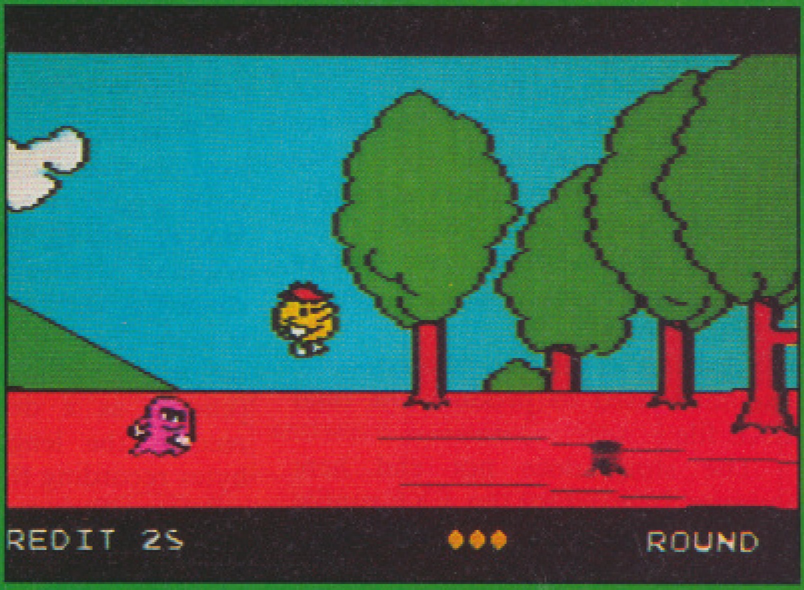
Hitting the joystick twice to the right will give you extra speed and height – a must for when you come across – yes, you've guessed it – a power pill – YIPEE! Eating this will reverse the who-eats-who role and you can munch your way through as many as you dare before they change from tasty blue to hungry red, greens and yellows! Eating a few cherries *en route* will top up your energy level even more, which can be crucial, as there's nothing more annoying than coming to a grinding halt just before you reach Break Time.

Energy is represented by a bar of withering Pacman who will gradually diminish in size. If it runs out Pacman will be beset relentlessly by the ghosts and a life is swiftly lost. Don't relax too much in Break Time with the scenic view of the, err, church (?!). The fairy appears from under Pacman's hat for some fresh air and to award bonus points based on the amount of energy he has left.

It's not long until you're onto the next level. Pacman is now in the country, jumping over tree stumps, gobbling those cherries for vital energy. But beware — do not get too tempted by the cherries when the ghosts are about — it's very easy to be killed by these pac-eating fiends.

Following a relatively easy journey so far, now it's time for a bit of skill to come into play. Jump over the tree stumps again but this time there are the ghosts to contend with as well, and they will swoop down to your level. It's intensely annoying when you're cowardishly hiding behind a stump, thinking they'll miss you, and then, suddenly – WHAM (this isn't Batman, Sue – Ed) they've swooped and knocked your brains out!

Get through this one and you've got the vertically moving rolling logs to contend with. Nerves of steel required for this one – balance yourself, eat those damn cherries, jump to the next log and avoid the ghosts in planes at the same time – not forgetting you haven't got all the time in the world to ponder your dilemma, as the evil purple ghost from behind will soon be upon you.



Suddenly the door to Fairyland is in sight – just avoid a few more perilous ghosts and walk through the door. You'll fall and land with a soft bump in Fairyland, where the fairy is released. The Fairy Queen greets you and supposedly rewards Pacman with flying shoes! Here you can take a breather before you prepare yourself for the treacherous journey home.

And it's here that you'll really have to be on your guard. The hazards are basically the same, but now everything seems to attack at once. However your skills should be quite sharp at this point to take you home to your wife and children, who will praise you for your bravery.

All in all, it's a lot of fun if you've got a few hours to spare and the patience of a Saint! The colours are, well, colourful! and the game has an authentic cartoon feel to it. Although the tune is catchy to begin with, it soon becomes monotonous (I think everybody in the office will agree, although their choice of adjectives would not be quite as select!).

Overall, a game which seems easy to master, but basically isn't, and keeps you going back for that eternal one more go, out of sheer frustration. Well, that's all folks, after all it's nearly 6 pm...

S.J.

Touchline:
Title: *Pacland.* ***Supplier:*** *Quicksilva, 12-18 Paul Street, London EC2A 4JS.* ***Tel:*** *01-247 6434.* ***Machine:*** *C64.* ***Price:*** *£9.95 (Ca) £14.95 (Disk).*

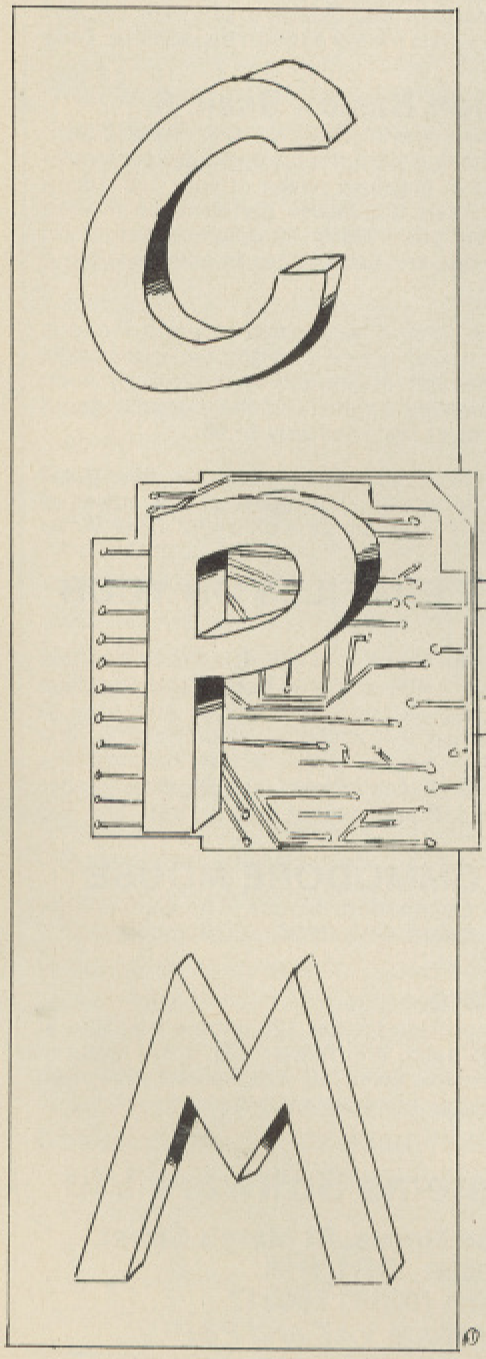
CP/M Printer Interfacing

By William Sellers

Connect your printer directly to the user port using CP/M user port centronics support

Centronics style parallel printers are frequently used with microcomputers. They can be used with the Commodore 128 by either buying an interface unit which is connected to the serial port, or by connecting the printer directly to the user port and using appropriate driver software. The latter option is obviously cheaper – especially if you make up your own lead, but has not been available in CP/M mode until now.

As an added bonus, since the program uses standard resident system extensions format, it can be used with almost any CP/M program that produces printer output. There should be no memory conflicts.



How it Works

As mentioned before, the program is a Resident System eXtension or RSX. This is a feature of CP/M plus not found in earlier versions that is extremely useful for allowing the programmer to customise system commands.

In a CP/M program, all interaction with system hardware is done through the BDOS jump vector at 0005h (as an aside, since we are now talking Z80 rather than 6502, hexadecimal numbers are denoted by putting an 'h' after them rather than a '$' before). A RSX diverts this vector so that it can examine all input/output calls before passing them onto the rest of the system. In this case, it looks for printer output which it processes itself.

Centronics protocol on the user port is fairly straightforward. The character data is put onto port B (pins C to L). Then the strobe on port A bit 2 (pin M) is momentarily brought low to indicate that valid data is present to the printer. The computer then waits to receive the acknowledge signal on flag (pin B). This allows the printer to tell the computer when it is ready to be sent more data.

Getting it all in

Two methods for typing in the program are shown. Which you use will depend on personal preference and how much additional CP/M software you possess. The first one uses only those programs supplied with the C128 on the system disk and the second requires the extra utility programs available from Commodore.

Method 1 – listing 1 is a BASIC loader that is typed into the computer in normal C128 mode and a copy is saved. The program POKEs the Z80 machine code into an area of memory in bank 1 that is not used when CP/M is booted up. When the program reports no errors, run it, put the CP/M system disk into the disk drive and type BOOT. When you see the CP/M system prompt, insert the utilities disk (this may be on the reverse side of the system disk) and type SAVE.

You will then be greeted by the system prompt again. This is because CP/M plus save works on exiting from another program. So, type SAVE again and this time you will be asked for a filename. Type in CENT.COM (the name is not important, but the file type must be .COM) – you are then prompted for a start address – type 8000 – and an end address – type 8280. The program will now be saved to disk.

Method 2 – initially you must use PIP to copy the following files onto a single disk: RMAC.COM, Z80.LIB and LINK.COM from the additional utilities disk; SUBMIT.COM and GENCOM.COM from the system disk. You will probably also need to copy over the next editor that you use. ED.COM will do if you have nothing else but there are some much better ones sitting around in the public domain.

Using your text editor, type in listing 2. This is a Z80 assembly language listing using the non-standard OP codes understood by RMAC. It should be saved to disk as CENT.ASM. The unusual looking data block at the beginning is the header required to show that this is a RSX file and not a normal program. Then type in listing 3. This is a batch processing file that performs all the

necessary steps to produce the required CENT.COM file (plus lots of others on the way!). This should be saved as RSX.SUB. Once this lot is all on the disk, type CENT.SUB CENT and stand back.

In Use

Contrary to the rather tortuous way of producing the program file using it could not be simpler. Just type CENT. at the console. CENT.COM is loaded into memory and the loader checks for the RSX header. Finding this, the program is relocated up to the top of the Transient Program Area and the BDOS jump vector is automatically altered to point to the new routine. Any other RSXs can be used at the same time too.

To test, use PIP to print out a file. Type PIP LIST:=filename where 'filename' is the name of your text files. Note that you will need to copy PIP onto the disk to do this.

If you use the program a lot, it is probably worth putting it into your PROFILE.SUB file on your boot up disk so that you can forget about it.

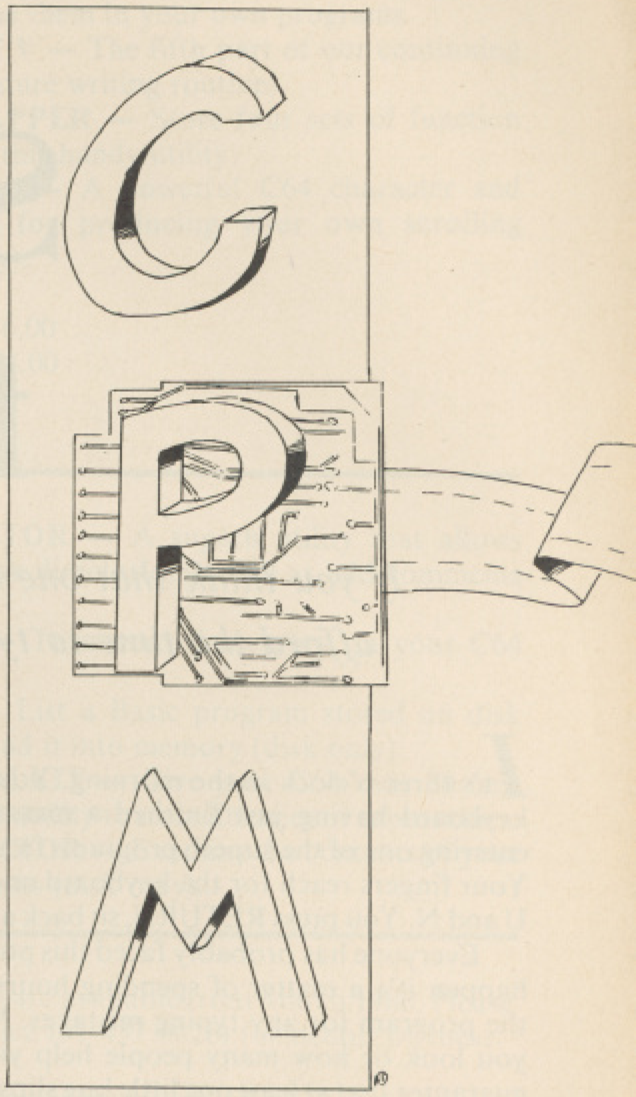
Wiring

The lead to connect the user port to the printer is the standard type used by Easyscript and other programs. These are available ready made up, or you can follow the instructions on page 32 to make up your own.

Limitations

Well, nothing is perfect and there are some circumstances where the centronics output RSX will not work. The program relies on the printer output being via the BDOS vector. This should be the case for all CP/M programs, but printer output can be achieved in other ways, notably by direct BDOS calls, and these will bypass the new routine. Also, redirection of screen output by typing control P will not work. This can be mimicked by using PUT to produce a disk file of screen output and printing this off later with PIP. YC

See listings on page 74.



Software for Sale

If you think that one of our programs looks very interesting, but you can't afford the time to type it in then our software service will help you out

It's three o'clock in the morning. You sit at the computer keyboard having just finished a marathon typing session entering one of the superb programs from *Your Commodore*. Your fingers reach for the keyboard and press the letters R, U and N. You press RETURN, sit back and nothing happens.

Everyone has probably faced this problem. When it does happen it's a matter of spending hours searching through the program for any typing mistakes. No matter how long you look or how many people help you, you can usually guarantee that at least one little bug slips through unnoticed.

The *Your Commodore* Software Service makes available all of the programs from each issue on both cassette and disk at a price of £6.00 for disk and £4.00 for cassette. None of the documentation for the programs is supplied with the software since it is all available in the relevant magazine. Should you not have the magazine then back issues are available from the following address:

INFONET LTD, 5 River Park Estate, Berkhamsted, Herts HP4 1HL.
Tel: (04427) 76661

Please contact this address for prices and availability.

The Disk

Programs on the disk will also be supplied as totally working versions, i.e. when possible we will not use Basic Loaders thus making use of the programs much easier. Unfortunately at the moment we cannot duplicate C16 and Plus/4 cassettes. However programs for these machines will be available on the disk.

What programs are available?

At the top of each article you will find a strap containing the article type, C64 Program etc. So that you can see which programs are available on which format, you will also find a couple of symbols after this strap. The symbols have the following meaning:

This symbol means that the program is available on cassette.

These programs are available on disk.

Please Note

Since the programs supplied on cassette are total working versions of the program, we do not put disk-only programs on tape. There is no sense in placing a program that expects to be reading from disk on to tape.

FEBRUARY 1988

ACKROYD'S SAGA — See January 1988
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TABULATE — Format your numerical printouts with ease (C64).
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JUNE '88

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DISK SECTOR EDITOR — Examine the contents of your Commodore 1541 disks (disk only).

Cassettes or disks are available from March 1986. Please ring the editorial office (01-437 0626) for details of these.

ORDER FORM – PLEASE COMPLETE IN BLOCK CAPITALS

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Listings

Get it right first time with our deluxe program system for the C64.

You may have noticed that our listings are free of those horrible little black blobs which send you searching around the keyboard for a suitable graphic symbol. You may also have noticed the funny numbers by the side of each line of the listing. Fret no more, it's all part of our easy entry aid.

Instead of those nasty graphics and rows of countless spaces in PRINT statements and strings we use a special coding system. The code, or mnemonic, is always contained in square brackets and you'll soon learn to decipher their meanings.

For example, [SA] would mean type in a Shifted A, or an ace of spades in layman's terms, and [SA10] would mean a row of ten of these symbols.

[S+2] means hold down the shift key and press the plus key twice. It doesn't take a great leap of logic to realise that [C+2] means exactly the same thing except that the Commodore key (bottom left of the keyboard) is held down instead of the shift key.

If more than two spaces appear in a statement then this will be printed as [SPC4] or, exceptionally, [SSPC4]. Translated into English this means press the spacebar four times or in the latter case hold the shift key down while you do it.

A string of special characters could appear as:

[CTRL N, DOWN2,LEFT5,BLUE, F3,C3]

This would be achieved by holding down the CTRL key as you press N, press the cursor key down twice, the cursor left key five times, press the key marked BLUE while holding down the CTRL key, press the F3 key and, finally hold the Commodore key down while pressing the number two key (C2 would of course make the computer print in brown).

Always remember that you should only have a row of graphics characters on your screen with no square brackets and no commas, unless something like this appears:

[SS],[C*]

In this case the two characters should have a comma between them.

On rare occasions [REV T] will appear in a listing. This is a delete symbol and is created by entering the line up to this mnemonic. Then type a closing quotation mark (SHIFT & 2) and delete it. This gets the computer out of quotes mode. Hold down CTRL and press the number nine key (RVSON), type the relevant number of reversed T's and then hold down CTRL and press zero (RVSOFF). Next type another quotation mark and delete it again. Now finish the line and press RETURN.

A list of these special cases is given in the table but remember that only one of these mnemonics will appear outside of a PRINT string: the symbol for pi. This may appear when its value is needed in a calculation so this may look something like:

:CC=2*[PI]*R:

Ignore the square brackets and just type in a shifted upward pointing arrow (ie. the pi symbol).

```
PROGRAM: SYNTAX CHECKER

5 REM SYTAX CHECKER - ERIC DOYLE

10 BL=10    :LN=70    :SA=49152
20 FOR L=0 TO BL:CX=0:FOR D=0 TO
 15
30 READ A:IF A>255THENPRINT"NUMB
ER TO LARGE";LN+(L*10):STOP
40 CX=CX+A:POKE SA+L*16+D,A:NEXT
 D
50 READ A:IF A><CX THENPRINT"ERR
OR IN LINE";LN+(L*10):STOP
60 NEXT L:SYS 49152:NEW
70 DATA 173,5,3,201,165,208,31,1
20,169,9,141,32,208,141,33,208,1
847
80 DATA 169,7,141,134,2,169,13,3
2,210,255,169,64,141,4,3,169,168
2
90 DATA 192,141,5,3,88,96,120,16
9,124,141,4,3,169,165,141,5,1566

100 DATA 3,169,14,141,134,2,141,
32,208,169,6,141,33,208,88,96,15
85
110 DATA 32,124,165,72,138,72,15
2,72,162,0,165,20,133,254,165,21
,1747
120 DATA 24,101,254,133,254,189,
0,2,240,18,69,254,133,254,232,18
9,2346
130 DATA 0,2,240,8,24,101,254,13
3,254,232,208,233,169,1,141,134,
2134
140 DATA 2,165,254,74,74,74,74,3
2,156,192,32,210,255,165,254,41,
2054
150 DATA 15,32,156,192,32,210,25
5,169,13,32,210,255,169,13,32,21
0,1995
160 DATA 255,169,7,141,134,2,104
,168,104,170,104,96,24,105,48,20
1,1832
170 DATA 58,16,1,96,24,105,7,96,
0,0,0,0,0,0,0,0,403
```

by Eric Doyle

Checksum Program

The hexadecimal numbers appearing in a column to the left of the listing should not be typed in with the program. These are merely checksum values and are there to help you get each line right. Don't worry if you don't understand the hexadecimal system, as long as you can compare two characters on the screen with the corresponding two characters in the magazine you can use our line checking program.

Type in the Checksum Program, make sure that you've not made any mistakes and save it to tape or disk immediately because it will be used with most of the present and future listings appearing in Your Commodore.

At the start of each programming session, load Checksum and run it. The screen will turn brown with yellow characters and each time you type in a line and press the RETURN key a number will appear on the screen in white. This should be the same as the corresponding value in the magazine.

If the two values don't relate to one another, you have not copied the line exactly as printed so go back and check each character carefully. When you find the error simply correct it and press RETURN again.

If you want to turn off the checker simply type SYS49152 and the screen will return to the familiar blue colours. You can then do whatever it was you wanted to do and if this doesn't use the area where Checksum lies you can go back to it with the same SYS command.

No system is foolproof but the chances of two errors cancelling one Many of the listings are presented in lower case. To turn your computer to lower case mode press the Commodore key and the SHIFT key at the same time. YC

Mnemonic	Symbol	Keypress
[RIGHT]		CRSR left/right
[LEFT]		SHIFT & CRSR left/right
[DOWN]		CRSR up/down
[UP]		SHIFT & CRSR up/down
[F1]		f1 key
[F2]		SHIFT & f1 key
[F3]		f3 key
[F4]		SHIFT & f3 key
[F5]		f5 key
[F6]		SHIFT & f5 key
[F7]		f7 key
[F8]		SHIFT & f7 key
[HOME]		CLR/HOME
[CLR]		SHIFT & CLR/HOME
[RVSON]		CTRL & 9
[RVSOFF]		CTRL & 0

Mnemonic	Symbol	Keypress
[BLACK]		CTRL & 1
[WHITE]		CTRL & 2
[RED]		CTRL & 3
[CYAN]		CTRL & 4
[PURPLE]		CTRL & 5
[GREEN]		CTRL & 6
[BLUE]		CTRL & 7
[YELLOW]		CTRL & 8
[POUND]		£
[LARROW]		←
[UPARROW]		↑
[PI]		SHIFT & ↑
[INST]		SHIFT & INST/DEL
[REV T]		see text
[Cletter]		CBM + letter
[Sletter]		SHIFT + letter

YOUR COMMODORE Listings

EASIPRINT

PROGRAM: EASIPRINT DEMO

```
10 IF L%=0 THEN L%=1:LOAD "EASIP
RINT CODE",8,1
20 POKE 55,121:POKE 56,120:CLR:S
YS 32757
30 OPEN 4,4,0
40 *RESET
50 *RETURN
60 *PICA
70 PRINT#4,"THIS IS PICA PITCH."
80 *ELITE
90 PRINT#4,"THIS IS ELITE PITCH.
":*RESET
100 *EXPANDED
110 PRINT#4,"THIS IS EXPANDED PR
INTING.":*RESET
120 *RVSON
130 PRINT#4,"THIS IS REVERSE PRI
NTING.":*RESET
140 *NLQ ON
150 PRINT#4,"THIS IS NLQ PRINTIN
G.":*RESET
160 *COMPRESSED ON
170 PRINT#4,"THIS IS COMPRESSED
PRINTING.":*RESET
180 *PROPORTIONAL ON
190 PRINT#4,"THIS IS PROPORTIONA
L PRINTING.":*RESET
200 *EMPHASIZED ON
210 PRINT#4,"THIS IS EMPHASIZED
PRINTING.":*RESET
220 *DOUBLESTRIKE ON
230 PRINT#4,"THIS IS DOUBLE-STRI
KE PRINTING.":*RESET
240 *ITALIC ON
250 PRINT#4,"THIS IS ITALIC PRIN
TING.":*RESET
260 *UNDERLINE ON
270 PRINT#4,"THIS IS UNDERLINED
PRINTING.":*RESET
280 *SUPERSCRIPT ON
290 PRINT#4,"THIS IS SUPERSCRIPT
 PRINTING.":*RESET
300 *SUBSCRIPT ON
310 PRINT#4,"THIS IS SUBSCRIPT P
RINTING.":*RESET
320 CLOSE4
330 *RETURN
340 *TEST
350 *RETURN
```

PROGRAM: EASIPRINT LOADER

```
10 POKE 55,121:POKE 56,120:CLR:P
RINTCHR$(27)"R"
20 RESTORE
30 A=30841:FOR L=190 TO 2590 STE
P 10
40 PRINT"[HOME]STORING LINE NUMB
ER"L
50 C%=0:FOR B=0 TO 7:READ N$:N%=
DEC(N$)
60 C%=C%+N%:POKE A,N%:A=A+1:NEXT
 B:READ V%
70 IF C%<>V% THEN PRINT"[DOWN]CH
ECKSUM ERROR FOUND IN LINE"L:END
80 NEXT L:PRINT"[DOWN]DATA CORRE
CT - TAPE OR DISK? (T/D)
90 DO:GET K$:LOOP UNTIL K$="T"OR
 K$="D"
100 IF K$="T"THEN POKE 208,1:ELS
E POKE 208,8
110 PRINT"[DOWN]INSERT EASIPRINT
 ";:IF K$="T"THEN PRINT"TAPE";:E
LSE PRINT"DISK";
120 PRINT" AND PRESS RETURN"
130 DO:GET K$:LOOP UNTIL K$=CHR$
(13):PRINT"[DOWN]SAVING BASIC LO
ADER..."
140 SAVE "EASIPRINT LOADER",PEEK
(208)
150 PRINT"[DOWN]SAVING EASIPRINT
 MACHINE CODE..."
160 POKE 43,121:POKE 44,120:POKE
 45,0:POKE 46,128:SAVE "EASIPRIN
T CODE",PEEK(208)
170 PRINT"[DOWN]SAVING COMPLETE
- PRESS RETURN TO STOP[HOME][HOM
E]"
180 DO:GET K$:LOOP UNTIL K$=CHR$
(13):SYS 32768
```

```
190 DATA 44,49,53,41,42,4C,45,FF
, 755
200 DATA FF,FF,FF,FF,FF,C0,C3,FF
, 1917
210 DATA FF,FF,FF,FF,FF,FF,FF,54
, 1869
220 DATA 45,53,54,FF,FF,FF,FF,FF
, 1511
230 DATA FF,FF,FF,FF,C0,C4,FF,FF
, 1918
240 DATA FF,FF,FF,FF,FF,FF,53,4F
, 1692
250 DATA 43,52,41,54,45,53,FF,FF
, 960
260 DATA FF,FF,FF,C0,C5,FF,FF,FF
, 1919
270 DATA FF,FF,FF,FF,FF,50,49,43
, 1495
280 DATA 41,FF,FF,FF,FF,FF,FF,FF
, 1850
290 DATA FF,FF,1B,50,FF,FF,FF,FF
, 1637
300 DATA FF,FF,FF,FF,45,4C,49,54
, 1322
310 DATA 45,FF,FF,FF,FF,FF,FF,FF
, 1854
320 DATA FF,1B,4D,FF,FF,FF,FF,FF
, 1634
330 DATA FF,FF,FF,52,45,53,45,54
, 1152
340 DATA FF,FF,FF,FF,FF,FF,FF,FF
, 2040
350 DATA 1B,40,FF,FF,FF,FF,FF,FF
, 1621
360 DATA FF,FF,8E,FF,FF,FF,FF,FF
, 1927
370 DATA FF,FF,FF,FF,FF,FF,FF,0D
, 1798
380 DATA FF,FF,FF,FF,FF,FF,FF,FF
, 2040
390 DATA FF,4C,49,4E,45,46,45,45
, 759
400 DATA 44,FF,FF,FF,FF,FF,0A,FF
, 1608
410 DATA FF,FF,FF,FF,FF,FF,FF,FF
, 2040
420 DATA 53,50,41,43,45,31,AD,36
, 640
430 DATA FF,FF,FF,FF,FF,1B,32,FF
, 1607
440 DATA FF,FF,FF,FF,FF,FF,FF,53
, 1868
450 DATA 50,41,43,45,31,AD,38,FF
, 814
460 DATA FF,FF,FF,FF,1B,30,FF,FF
, 1605
470 DATA FF,FF,FF,FF,FF,FF,53,50
, 1693
480 DATA 41,43,45,37,AD,37,32,FF
, 789
490 DATA FF,FF,FF,1B,31,FF,FF,FF
, 1606
500 DATA FF,FF,FF,FF,FF,81,4D,46
, 1551
510 DATA 45,45,44,FF,FF,FF,FF,FF
, 1481
520 DATA FF,FF,0C,FF,FF,FF,FF,FF
, 1797
530 DATA FF,FF,FF,FF,54,41,42,FF
, 1490
540 DATA FF,FF,FF,FF,FF,FF,FF,FF
, 2040
550 DATA FF,09,FF,FF,FF,FF,FF,FF
, 1794
560 DATA FF,FF,FF,56,45,52,54,49
, 1159
570 DATA 43,41,4C,54,41,42,FF,FF
, 933
580 DATA 0B,FF,FF,FF,FF,FF,FF,FF
, 1796
590 DATA FF,FF,43,41,4E,43,45,4C
, 932
600 DATA 4C,49,4E,45,FF,FF,FF,1B
, 1085
610 DATA FF,FF,FF,FF,FF,FF,FF,FF
, 2040
620 DATA FF,91,4C,49,4E,45,FF,FF
, 1206
630 DATA FF,FF,FF,FF,FF,FF,11,FF
, 1802
640 DATA FF,FF,FF,FF,FF,FF,FF,FF
, 2040
650 DATA 4F,46,46,4C,49,4E,45,FF
, 770
660 DATA FF,FF,FF,FF,FF,13,FF,FF
, 1804
670 DATA FF,FF,FF,FF,FF,FF,FF,BD
, 1974
680 DATA AF,45,44,FF,FF,FF,FF,FF
, 1587
690 DATA FF,FF,FF,FF,0E,FF,FF,FF
, 1799
700 DATA FF,FF,FF,FF,FF,FF,53,C0
, 1805
710 DATA 44,41,52,44,FF,FF,FF,FF
, 1303
720 DATA FF,FF,FF,0F,FF,FF,FF,FF
, 1800
730 DATA FF,FF,FF,FF,FF,55,50,50
, 1520
740 DATA 45,52,4C,4F,57,45,52,FF
, 799
750 DATA FF,FF,11,FF,FF,FF,FF,FF
, 1802
760 DATA FF,FF,FF,FF,DE,53,FF,FF
, 1835
770 DATA FF,FF,FF,FF,FF,FF,FF,FF
, 2040
780 DATA FF,91,FF,FF,FF,FF,FF,FF
, 1930
790 DATA FF,FF,FF,52,56,53,91,FF
, 1416
800 DATA FF,FF,FF,FF,FF,FF,FF,FF
, 2040
810 DATA 12,FF,FF,FF,FF,FF,FF,FF
, 1803
820 DATA FF,FF,52,56,53,4F,46,46
, 980
830 DATA FF,FF,FF,FF,FF,FF,FF,92
, 1931
840 DATA FF,FF,FF,FF,FF,FF,FF,FF
, 2040
850 DATA FF,42,49,54,49,4D,41,47
, 764
860 DATA 45,FF,FF,FF,FF,FF,08,FF
, 1607
870 DATA FF,FF,FF,FF,FF,FF,FF,FF
, 2040
880 DATA 4A,55,53,54,8B,59,4C,45
, 699
890 DATA 46,54,FF,FF,FF,1B,61,00
, 1043
900 DATA FF,FF,FF,FF,FF,FF,FF,43
, 1852
910 DATA 45,4E,54,45,52,FF,FF,FF
, 1147
920 DATA FF,FF,FF,FF,1B,61,01,FF
, 1400
930 DATA FF,FF,FF,FF,FF,FF,4A,55
, 1689
940 DATA 53,54,8B,59,52,49,47,48
, 693
950 DATA 54,FF,FF,1B,61,02,FF,FF
, 1230
960 DATA FF,FF,FF,FF,FF,4A,55,53
, 1517
970 DATA 54,8B,59,42,4F,54,48,FF
, 868
980 DATA FF,FF,1B,61,03,FF,FF,FF
, 1402
990 DATA FF,FF,FF,FF,49,4E,43,52
, 1320
1000 DATA 45,41,53,45,FF,FF,FF,F
F, 1306
1010 DATA FF,1B,20,C0,C1,FF,FF,F
F, 1464
1020 DATA FF,FF,FF,E0,41,43,54,4
5, 1274
1030 DATA 52,53,45,54,FF,FF,FF,F
F, 1338
1040 DATA 1B,52,C0,C1,FF,FF,FF,F
F, 1514
1050 DATA FF,FF,50,41,47,45,53,4
9, 951
1060 DATA 5A,45,4C,49,4E,45,FF,1
B, 737
1070 DATA 43,C0,C1,FF,FF,FF,FF,F
F, 1727
1080 DATA FF,50,41,47,45,53,49,5
A, 786
1090 DATA 45,49,4E,43,48,FF,1B,4
3, 708
1100 DATA 00,C0,C1,FF,FF,FF,FF,F
F, 1660
1110 DATA 4C,45,46,54,4D,41,52,4
7, 594
1120 DATA 49,4E,FF,FF,FF,1B,6C,C
0, 1243
1130 DATA C1,FF,FF,FF,FF,FF,FF,5
2, 1805
1140 DATA 49,47,48,54,4D,41,52,4
7, 595
1150 DATA 49,4E,FF,FF,1B,51,C0,C
1, 1154
1160 DATA FF,FF,FF,FF,FF,FF,53,4
5, 1682
1170 DATA 54,48,54,B6,FF,FF,FF,F
F, 1442
1180 DATA FF,FF,FF,1B,65,00,C0,C
1, 1278
1190 DATA FF,FF,FF,FF,FF,52,45,4
C, 1502
1200 DATA 41,54,49,56,45,54,41,4
2, 592
1210 DATA FF,FF,1B,66,00,C0,C1,F
F, 1279
1220 DATA FF,FF,FF,FF,EB,54,B6,4
F, 1600
1230 DATA 4C,55,54,45,FF,FF,FF,F
F, 1334
1240 DATA FF,1B,24,C0,C2,FF,FF,F
F, 1469
1250 DATA FF,FF,FF,EB,54,52,45,4
C, 1311
1260 DATA 41,54,49,56,45,FF,FF,F
F, 1142
1270 DATA 1B,5C,C0,C2,FF,FF,FF,F
F, 1525
1280 DATA FF,FF,53,45,54,56,54,B
6, 1098
1290 DATA FF,FF,FF,FF,FF,FF,FF,1
B, 1812
1300 DATA 65,01,C0,C1,FF,FF,FF,F
F, 1507
1310 DATA FF,41,44,56,41,4E,43,4
5, 753
1320 DATA 50,41,50,45,52,FF,1B,6
6, 760
1330 DATA 01,C0,C1,FF,FF,FF,FF,F
F, 1661
1340 DATA BF,47,4C,45,44,45,4E,5
3, 705
1350 DATA 49,54,59,FF,FF,1B,4B,C
0, 1050
1360 DATA C2,FF,FF,FF,FF,FF,FF,E
B, 1959
1370 DATA 55,42,4C,45,44,45,4E,5
3, 594
1380 DATA 49,54,59,FF,1B,4C,C0,C
```

```
2, 990
1390 DATA FF,FF,FF,FF,FF,FF,46,4
1, 1665
1400 DATA 53,54,EB,55,42,4C,45,F
F, 953
1410 DATA FF,FF,FF,1B,59,C0,C2,F
F, 1522
1420 DATA FF,FF,FF,FF,FF,51,55,4
1, 1506
1430 DATA 44,44,45,4E,53,49,54,5
9, 612
1440 DATA FF,FF,1B,5A,C0,C2,FF,F
F, 1523
1450 DATA FF,FF,FF,FF,4E,4C,51,F
F, 1510
1460 DATA FF,FF,FF,FF,FF,FF,FF,F
F, 2040
1470 DATA FF,1B,78,01,FF,FF,1B,7
8, 1060
1480 DATA 00,FF,FF,EB,55,42,4C,4
5, 1041
1490 DATA 57,49,44,54,48,FF,FF,F
F, 1149
1500 DATA 1B,57,01,FF,FF,1B,57,0
0, 739
1510 DATA FF,FF,43,4F,4D,50,52,4
5, 964
1520 DATA 53,53,45,44,FF,FF,FF,1
B, 1095
1530 DATA 0F,FF,FF,FF,1B,12,FF,F
F, 1335
1540 DATA FF,50,52,4F,50,80,54,4
9, 909
1550 DATA 91,41,4C,FF,FF,FF,1B,7
0, 1190
1560 DATA 01,FF,FF,1B,70,00,FF,F
F, 1160
1570 DATA 45,4D,50,48,41,53,49,5
A, 609
1580 DATA 45,44,FF,FF,FF,1B,45,F
F, 1253
1590 DATA FF,FF,1B,46,FF,FF,FF,E
B, 1607
1600 DATA 55,42,4C,45,53,54,52,4
9, 618
1610 DATA 4B,45,FF,FF,1B,47,FF,F
F, 1262
1620 DATA FF,1B,48,FF,FF,FF,49,5
4, 1276
1630 DATA 41,4C,49,43,FF,FF,FF,F
F, 1301
1640 DATA FF,FF,FF,1B,34,FF,FF,F
F, 1609
1650 DATA 1B,35,FF,FF,FF,55,4E,4
4, 1076
1660 DATA 45,52,4C,49,4E,45,FF,F
F, 957
1670 DATA FF,FF,1B,2D,01,FF,FF,1
B, 1120
1680 DATA 2D,00,FF,FF,52,45,56,4
5, 861
1690 DATA 52,53,45,FF,FF,FF,FF,F
F, 1509
1700 DATA FF,1B,72,FF,FF,FF,1B,7
4, 1304
1710 DATA FF,FF,FF,53,55,50,45,5
2, 1164
1720 DATA 53,43,52,49,50,54,FF,F
F, 979
1730 DATA 1B,53,00,FF,FF,1B,54,F
F, 986
1740 DATA FF,FF,53,55,42,53,43,5
2, 976
1750 DATA 49,50,54,FF,FF,FF,FF,1
B, 1284
1760 DATA 53,01,FF,FF,1B,54,FF,F
F, 1215
1770 DATA FF,EB,55,42,4C,45,48,4
5, 927
1780 DATA 49,47,48,54,FF,FF,1B,6
8, 941
1790 DATA FF,FF,FF,1B,75,FF,FF,F
F, 1674
1800 DATA EB,57,4E,93,FF,FF,FF,F
F, 1567
1810 DATA FF,FF,FF,FF,FF,1B,25,0
1, 1340
1820 DATA 00,FF,1B,25,00,00,FF,5
5, 659
1830 DATA 4E,49,44,49,52,45,43,5
4, 594
1840 DATA 49,91,FF,FF,1B,55,01,F
F, 1096
1850 DATA FF,1B,55,00,FF,FF,53,4
C, 1036
1860 DATA 41,53,48,45,44,5A,45,5
2, 598
1870 DATA 4F,FF,FF,1B,7E,34,01,F
F, 1050
1880 DATA 1B,7E,34,00,FF,50,41,5
0, 685
1890 DATA 45,52,4F,55,54,FF,FF,F
F, 1164
1900 DATA FF,FF,1B,39,FF,FF,FF,1
B, 1386
1910 DATA 38,FF,FF,FF,54,48,49,5
3, 1133
1920 DATA 20,49,53,20,41,20,54,4
5, 470
1930 DATA 53,54,20,50,52,49,4E,5
4, 596
1940 DATA 20,50,52,4F,44,55,43,4
5, 562
1950 DATA 44,20,42,59,20,22,45,4
1, 455
1960 DATA 53,49,50,52,49,4E,54,2
2, 587
1970 DATA 0D,28,43,29,20,43,4F,5
0, 419
1980 DATA 59,52,49,47,48,54,20,3
1, 552
1990 DATA 39,38,38,20,53,4F,43,5
2, 512
2000 DATA 41,54,45,53,20,44,45,5
6, 556
2010 DATA 45,4C,4F,50,4D,45,4E,5
4, 612
2020 DATA 20,55,4E,4C,49,4D,49,5
4, 578
2030 DATA 45,44,2E,0D,22,45,41,5
3, 447
2040 DATA 49,50,52,49,4E,54,22,2
0, 536
2050 DATA 57,41,53,20,57,52,49,5
4, 593
2060 DATA 54,45,4E,20,49,4E,20,4
D, 523
2070 DATA 41,52,43,48,20,31,39,3
8, 480
2080 DATA 38,20,42,59,20,4D,41,5
2, 499
2090 DATA 4B,20,45,56,45,52,49,4
E, 564
2100 DATA 47,48,41,4D,2E,0D,00,2
2, 378
2110 DATA 45,41,53,49,50,52,49,4
E, 603
2120 DATA 54,22,20,49,53,20,4E,4
F, 495
2130 DATA 57,20,44,49,53,41,42,4
C, 550
2140 DATA 45,44,2E,0D,22,53,4F,4
3, 459
2150 DATA 52,41,54,45,53,22,20,2
D, 494
2160 DATA 20,54,48,45,20,54,48,4
9, 518
2170 DATA 4E,4B,49,4E,47,20,4D,4
1, 549
2180 DATA 4E,53,20,53,4F,46,54,5
7, 596
2190 DATA 41,52,45,2E,0D,20,73,0
4, 426
2200 DATA C9,AC,F0,03,4C,D9,8B,A
9, 1217
2210 DATA 78,85,D0,A9,78,85,D1,A
2, 1254
2220 DATA 01,A0,01,B1,D0,C9,FF,F
0, 1243
2230 DATA 22,D1,3B,D0,04,C8,4C,D
4, 1002
2240 DATA 7E,E8,E0,3D,B0,10,18,A
5, 1024
2250 DATA D0,69,17,85,D0,A5,D1,6
9, 1156
2260 DATA 00,85,D1,4C,D2,7E,A9,A
C, 1095
2270 DATA 4C,D9,8B,A9,0E,84,D4,8
6, 1093
2280 DATA D3,A2,04,A0,00,20,BA,F
F, 1010
2290 DATA A9,00,20,BD,FF,20,C0,F
F, 1124
2300 DATA A2,0E,20,C9,FF,A6,D3,A
0, 1201
2310 DATA 0E,E0,2D,B0,25,B1,D0,8
5, 1014
2320 DATA D2,C9,C0,B0,07,20,D2,F
F, 1283
2330 DATA C8,4C,1E,7F,A5,D2,C9,F
F, 1264
2340 DATA F0,03,4C,56,7F,20,CC,F
F, 1023
2350 DATA A9,0E,20,C3,FF,A9,8F,4
C, 1053
2360 DATA D9,8B,A4,D4,C8,B1,3B,C
9, 1369
2370 DATA 91,F0,05,A0,13,4C,1E,7
F, 802
2380 DATA A0,0E,4C,1E,7F,C8,B1,D
0, 992
2390 DATA C9,C1,F0,53,C9,C2,F0,5
C, 1444
2400 DATA C9,C3,F0,08,C9,C4,F0,2
1, 1314
2410 DATA C9,C5,F0,2B,A9,D6,8D,0
8, 1213
2420 DATA 03,A9,88,8D,09,03,20,C
C, 700
2430 DATA FF,A0,00,B9,78,7E,C8,2
0, 1078
2440 DATA D2,FF,C9,0D,D0,F5,4C,3
6, 1262
2450 DATA 7F,A0,00,B9,DD,7D,F0,A
5, 1223
2460 DATA C8,20,D2,FF,4C,8C,7F,2
0, 1072
2470 DATA CC,FF,A0,00,B9,95,7E,C
8, 1279
2480 DATA 20,D2,FF,C9,0D,D0,F5,4
C, 1240
2490 DATA 36,7F,A9,AC,4C,D9,8B,2
0, 986
2500 DATA D3,7F,20,81,9D,8A,20,D
2, 1036
2510 DATA FF,4C,EA,7F,20,D3,7F,2
0, 1094
2520 DATA 3E,8E,A5,14,20,D2,FF,A
5, 1051
2530 DATA 15,20,D2,FF,4C,EA,7F,1
8, 979
2540 DATA 65,3B,A5,3B,85,D0,A5,3
C, 950
2550 DATA 85,D1,A4,D4,98,18,65,3
B, 1054
2560 DATA 85,3B,A9,00,65,3C,85,3
C, 715
2570 DATA 60,A5,D0,85,3B,A5,D1,8
5, 1168
2580 DATA 3C,4C,36,7F,A9,BE,8D,0
8, 825
2590 DATA 03,A9,7E,8D,09,03,60,0
0, 547
```

EASIPRINT/M.R EVERINGHAM/COMMAND REFERENCE

COMMAND	SYNTAX	DATA ADDRESS	FUNCTION
*DISABLE	-	$7879 (30841)	DISABLES EASIPRINT COMMANDS
*TEST	-	$7890 (30864)	PRINTS A TEST MESSAGE
*SOCRATES	-	$78A7 (30887)	FIND OUT FOR YOURSELF!
*PICA	-	$78BE (30910)	SELECTS PICA PITCH
*ELITE	-	$78D5 (30933)	SELECTS ELITE PITCH
*RESET	-	$78EC (30956)	RESETS PRINTER
*RETURN	-	$7903 (30979)	SENDS CARRIAGE-RETURN
*LINEFEED	-	$791A (31002)	SENDS LINEFEED
*SPACE1/6	-	$7931 (31025)	SETS SPACING TO 1/6"
*SPACE1/8	-	$7948 (31048)	SETS SPACING TO 1/8"
*SPACE7/72	-	$795F (31071)	SETS SPACING TO 7/72"
*FORMFEED	-	$7976 (31094)	MOVES PAPER TO NEXT SHEET
*TAB	-	$798D (31117)	MOVES TO NEXT HORIZONTAL TAB
*VERTICALTAB	-	$79A4 (31140)	MOVES TO NEXT VERTICAL TAB
*CANCELLINE	-	$79BB (31163)	ERASES LAST LINE IN BUFFER
*ONLINE	-	$79D2 (31186)	SETS PRINTER ON-LINE
*OFFLINE	-	$79E9 (31209)	SETS PRINTER OFF-LINE
*EXPANDED	-	$7A00 (31232)	TURNS EXPANDED ON (CBM)
*STANDARD	-	$7A17 (31255)	TURNS STANDARD ON (CBM)
*UPPERLOWER	-	$7A2E (31278)	TURNS UPPER/LOWER SET ON (CBM)
*GRAPHICS	-	$7A45 (31301)	TURNS GRAPHICS SET ON (CBM)
*RVSON	-	$7A5C (31324)	TURNS REVERSE ON (CBM)
*RVSOFF	-	$7A73 (31347)	TURNS REVERSE OFF (CBM)
*BITIMAGE	-	$7A8A (31370)	TURNS BITIMAGE MODE ON (CBM)
*JUSTIFYLEFT	-	$7AA1 (31393)	PRINT FLUSH AGAINST LEFT
*CENTER	-	$7AB8 (31416)	PRINT CENTERED BETWEEN MARGINS
*JUSTIFYRIGHT	-	$7ACF (31439)	PRINT FLUSH AGAINST RIGHT
*JUSTIFYBOTH	-	$7AE6 (31462)	JUSTIFY TEXT FULLY
*INCREASE	0-255	$7AFD (31485)	INCREASE PROPORTIONAL SPACING
*CHARACTERSET	0-255	$7B14 (31508)	SELECT INTERNATIONAL SET
*PAGESIZELINE	0-255	$7B2B (31531)	SET PAGE SIZE IN LINES
*PAGESIZEINCH	0-255	$7B42 (31554)	SET PAGE SIZE IN INCHES
*LEFTMARGIN	0-255	$7B59 (31577)	SET LEFT MARGIN
*RIGHTMARGIN	0-255	$7B70 (31600)	SET RIGHT MARGIN
*SETHTABS	0-255	$7B87 (31623)	SET HORIZONTAL TABS
*RELATIVETAB	0-255	$7B9E (31646)	MOVE HEAD RELATIVE
*DOTABSOLUTE	0-65535	$7BB5 (31669)	MOVE HEAD TO DOT ABSOLUTE
*DOTRELATIVE	0-65535	$7BCC (31692)	MOVE HEAD DOT RELATIVE
*SETVTABS	0-255	$7BE3 (31715)	SET VERTICAL TABS
*ADVANCEPAPER	0-255	$7BFA (31738)	MOVE PAPER FORWARD
*SINGLEDENSITY	0-65535	$7C11 (31761)	SET S.D GRAPHICS MODE
*DOUBLEDENSITY	0-65535	$7C28 (31784)	SET D.D GRAPHICS MODE
*FASTDOUBLE	0-65535	$7C3F (31807)	SET FAST D.D GRAPHICS MODE
*QUADDENSITY	0-65535	$7C56 (31830)	SET Q.D GRAPHICS MODE
*NLQ	ON/OFF	$7C6D (31853)	SELECT NEAR LETTER QUALITY
*DOUBLEWIDTH	ON/OFF	$7C84 (31876)	SELECT DOUBLEWIDTH (EPSON)
*COMPRESSED	ON/OFF	$7C9B (31899)	SELECT COMPRESSED
*PROPORTIONAL	ON/OFF	$7CB2 (31922)	SELECT PROPORTIONAL
*EMPHASIZED	ON/OFF	$7CC9 (31945)	SELECT EMPHASIZED
*DOUBLESTRIKE	ON/OFF	$7CE0 (31968)	SELECT DOUBLESTRIKE
*ITALIC	ON/OFF	$7CF7 (31991)	SELECT ITALIC
*UNDERLINE	ON/OFF	$7D0E (32014)	SELECT UNDERLINE
*REVERSE	ON/OFF	$7D25 (32037)	SELECT REVERSE (EPSON)
*SUPERSCRIPT	ON/OFF	$7D3C (32060)	SELECT SUPERSCRIPT
*SUPERSCRIPT	ON/OFF	$7D53 (32083)	SELECT SUBSCRIPT
*DOUBLEHEIGHT	ON/OFF	$7D6A (32106)	SELECT DOUBLE-HEIGHT
*DOWNLOAD	ON/OFF	$7D81 (32129)	SELECT RAM/ROM SET
*UNIDIRECTION	ON/OFF	$7D98 (32152)	SELECT BI/UNI DIRECTIONAL
*SLASHEDZERO	ON/OFF	$7DAF (32175)	SELECT SLASHED ZERO
*PAPEROUT	ON/OFF	$7DC6 (32198)	ENABLE PAPEROUT SENSOR

HANDY INPUT ROUTINES

PROGRAM: RESTRICTED INPUT

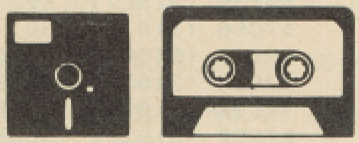
```
FB  1 PRINT"[CLR]":GOTO10
FA  2 ****************************
****
F2  3 RESTRICTED INPUT GOSUB ROU
TINE
0F  5 WRITTEN  BY
E8  7 NORMAN HART   (17DEC87)
F0  8 ****************************
****
33  9 :
A5  10 L=28:TB=4:RS=3:GOSUB200
D2  20 PRINT"[RVSON]"Y$:PRINT"A=
"A
F8  30 GOTO10
24  40 ************************
****
08  50 :
06  60 :
7C  70 :
6A  80 :
60  90 :
70  100 :RS=0:LETTERS+INTEGERS
B3  110 :RS=1:INTEGERS
25  120 :RS=2:LETTERS
EF  130 :RS=3:LETTERS+INTEGERS+P
UNCTUATION
1A  140 : L=LENGTH OF INPUT
20  150 :TB=TABULATION OF ROUTIN
E
```

```
9A  160 :
90  170 :
BE  180 :
BE  190 *************************
**********
F2  200 A=0:Y$="":SP=1
9B  210 PRINTTAB(TB+L+1):PRINT"]
";:FORX=0TOL+1:PRINT"[LEFT2] ";:
NEXT:PRINT"[[C@,
LEFT]";
D9  220 GETX$:IFX$=""THEN220
60  230 IFX$=CHR$(160)ORX$=" "OR
X$=CHR$(20)ORX$=CHR$(13)THEN300
6E  240 IFRS=1ORRS=0THENIFX$=>"0
"ANDX$=<"9"THEN300
53  250 IFRS=2ORRS=0THENIFX$=>"A
"ANDX$=<"Z"THEN300
A4  260 IFRS=3ANDX$=>CHR$(35)AND
X$=<CHR$(93)THEN300
BA  270 GOTO220
8A  280 IFA=L-1THENPRINT"[RIGHT]
][LEFT2]";
1E  290 GOTO220
BF  300 IFX$=CHR$(20)ANDA=0THEN2
20
8E  310 IFX$=CHR$(13)ANDRIGHT$(Y
$,1)=" "THENY$=LEFT$(Y$,LEN(Y$)-
1):A=A-1
D6  320 IFX$=CHR$(13)THENPRINT:R
ETURN
84  330 A=A+1:IFX$<>CHR$(32)THEN
SP=0
54  340 IFA>LANDX$<>CHR$(20)THEN
X$="":A=A-1
C7  350 IFA<1THENX$="":A=0
23  360 IFX$=CHR$(20)THENPRINTTA
B(A)"[LEFT,C@] [LEFT2]";:A=A-2:Y
$=LEFT$(Y$,LEN(Y
$)-1):GOTO280
4F  370 IFX$=CHR$(32)ANDSP=1THEN
X$="":A=A-1
41  380 IFX$=CHR$(32)THENSP=SP+1
B4  390 Y$=Y$+X$:PRINTX$;:IFA<LT
HENPRINT"[C@,LEFT]";
A8  400 GOTO220
```

PROGRAM: CURSOR DRIVEN MENU

```
65  70 GOTO240
6A  80 :
60  90 :
58  100 *******************
D6  120 CURSOR DRIVEN MENU
58  140 WRITTEN  BY
75  160 NORMAN HART
7B  180 *17 DEC 87
3C  200 *******************
E8  210 :
E6  220 :
5A  230 *************************
***********
3A  240 PRINT"[CLR]"
F6  250 PRINT"[DOWN5]"
D5  260 PRINT" ITEM 1[SPC3]ORDIN
ARY TEXT ABC
15  270 PRINT" ITEM 2[SPC3]SHIFT
ED TEXT [SA,SB,SC]
49  280 PRINT" ITEM 3[SPC3]COMMO
DORE TEXT [CA,CB,CC]
1F  290 PRINT" ITEM 4[SPC3]INTEG
ERS 12345
63  300 PRINT" ITEM 5[SPC3]SHIFT
ED INTEGERS !#$%&
07  310 PRINT" ITEM 6[SPC3]QUOTA
TION MARKS"CHR$(34)CHR$(34)
D8  320 PRINT
EB  330 PRINT"  MOVE CURSOR UP &
 DOWN:PRESS [RETURN]
6F  340 :
65  350 :
A4  360 PRINT"[HOME,DOWN6]":T1=9
:T2=10:LL=5:LN=25:GOSUB500
97  370 PRINT"[RVSON,HOME,DOWN16
]"SPC(T2)Y$:PRINTTAB(T2)"A="A
3F  380 FORX=1TO200:PRINT"[HOME]
"X:NEXT
0D  390 RUN
45  400 *************************
***********
A1  410 :
9F  420 :
41  430 : LL=LOWER LIMIT OF CURS
OR TRAVEL
32  440 : LN=LENGTH OF STRING RE
TURNED (Y$)
FF  450 : T1=TABULATION OF ">" C
URSOR
C3  460 : T2=TABULATION OF START
 OF STRING
ED  470 :
DB  480 :
5F  490 *************************
***********
3E  500 A=0:PRINTTAB(T1)">"
6A  510 GETX$:IFX$=""THEN510
75  520 IFA=LLANDX$=CHR$(17)THEN
A=A-1:PRINT"[UP2]"
04  530 IFA=0ANDX$=CHR$(145)THEN
A=A+1:PRINT
C6  540 IFX$=CHR$(17)THENA=A+1:P
RINTTAB(T1)"[UP] [LEFT,DOWN]>"
43  550 IFX$=CHR$(145)THENA=A-1:
PRINTTAB(T1)"[UP] [LEFT,UP]>"
1F  560 IFX$=CHR$(13)THENPRINTTA
B(T2)"[UP]";:GOTO580
0B  570 GOTO510
E4  580 OPEN1,3:FORX=1TOLN:GET#1
,X$:Y$=Y$+X$:NEXT:CLOSE1,3
DE  590 RETURN
EA  18017 DEC 87
```

MAKING MUSIC



PROGRAM:MAKING MUSIC

```
85  1 GOSUB20000:GOSUB40000:GOSU
    B60000:GOSUB2:GOSUB950:POKE5
    4295,0:GOTO20
3B  2 POKE53281,3:POKE53280,6:PO
    KES+1,220:POKES,59
4D  3 PRINT"[CLR]";:POKE53265,1:
    PRINTCHR$(14):POKES+21,1
99  4 A$="[BLUE,RVSON] [CN] [CN,
    RVSOFF]  [RVSON] [CN] [CN] [
    CN,RVSOFF]":B$="[WHITE,RVSON
    ] [CN,RVSOFF]":C$="[BLUE,RVS
    ON] [CN] [CN,WHITE,CN] [BLUE
    ,SSPC,CN,SSPC,CN,SSPC,CN,RVS
    OFF]"
C5  5 Z=2:GOSUB16:PRINT"[DOWN2]"
    :Z=4:GOSUB16:PRINT"[DOWN2]":
    Z=6:GOSUB16
00  6 FORI=0TO24:POKE1044+I*40,1
    18:POKE55296+20+I*40,6:NEXT
9D  7 PRINT"[HOME]"TAB(21)"[BLUE
    ,RVSON]  * 64 [SK]EYBOARD *
    ";
6D  8 PRINT:PRINTTAB(22)"[SP]LAY
     USING KEYS:":PRINTTAB(22)"[
    DOWN,SQ,SW,SE,SR,ST,SY,SU]
    [SF]1/[SF]2"
A5  9 PRINTTAB(23)"[SA,SS,SD,SF,
    SG,SH,SJ]  [SF]3/[SF]4":PRIN
    TTAB(24)"[SZ,SX,SC,SV,SB,SN,
    SM]  [SF]5/[SF]6":PRINTTAB(3
    4)"[SF]7/[SF]8"
C7  10 PRINTTAB(22)"[SU]SE THE [
    SS,SH,SI,SF,ST]":PRINTTAB(22
    )"KEY FOR A SHARP"
BD  11 PRINTTAB(21)"[CP19]";
62  12 PRINT:PRINTTAB(21)"'@'-UP
     OCTAVE":PRINTTAB(21)"'↑'-DO
    WN OCTAVE";:PRINT
69  13 PRINTTAB(21)"'*'-GLISSAND
    O":PRINT:PRINTTAB(21)"'='-GL
    ISSANDO
F2  14 PRINTTAB(25)"RATE":PRINT:
    PRINTTAB(21)"'1-7'-SELECT":P
    RINTTAB(27)"VOICES"
0C  15 PRINT:PRINTTAB(21)"'[SR,S
    E,ST,SU,SR,SN]'-VOICES":PRIN
    TTAB(21)"'[SC,ST,SR,SL]'-FIL
    TERS";:RETURN
82  16 PRINT"[DOWN2]":FORI=1TO5:
    FORJ=1TO7:PRINTTAB(Z-1)B$;:N
    EXTJ:PRINT:NEXTI
E6  17 PRINT"[UP8]":FORI=1TO2:PR
    INTTAB(Z)A$:NEXT:FORI=1TO2:P
    RINTTAB(Z)C$:NEXT
9C  18 RETURN
ED  20 FORI=0TO2:POKEV+I*7+5,AD(
    I):POKEV+I*7+6,SR(I):NEXT
61  25 K=PEEK(197):PS=PEEK(653):
    IFPS=4THEN800
8F  26 IFK=1THEN250
0F  27 IF(K>2ANDK<7)THEN700
95  28 IFK<35THEN85
A6  29 IFK=36ORK=37ORK=39ORK=47O
    RK=56ORK=59ORK=62THEN85
0A  30 IFK=0THENPOKEV,0:POKEV+1,
    0:GOTO25
3D  35 IFK=51THENPOKEV+7,0:POKEV
    +8,0:GOTO25
AC  40 IFK=48THENPOKEV+14,0:POKE
    V+15,0:GOTO25
BD  50 REM
D6  55 IFK=40THEN420
94  56 IFK=43THEN446
05  60 IFK=35THENRM=1-RM:GOTO450

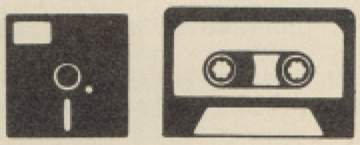
CA  65 IFK=46ANDOC>1THENOC=OC/2:
    GOTO900
93  70 IFK=54ANDOC<32THENOC=OC*2
    :GOTO900
A3  75 IFK=49THENGL=1-GL:PRINT"[
    HOME]"CD$"[UP2]"TAB(36)"[RVS
    ON]"GL$(GL)"[RVSOFF]";:GOTO2
    5
91  80 IFK=53THENGR=GR+1:IFGR>8T
    HENGR=0
8B  81 IFK=53THENPRINT"[HOME]"CD
    $TAB(36)"[RVSON]"GR"[RVSOFF]
    ":GOTO25
38  82 GOTO25
DA  85 REM
14  90 F=N(K):LK=K:LS=PS:X=X(K):
    Y=Y(K)
84  95 IFF=0THEN25
A4  100 IF(F>0ANDF<9)THEN225
3B  105 F=F*(4/OC)
5D  110 IFGLTHEN455
62  120 IFPS=1THENF=INT(F*2↑(1/1
    2)):X=X+8:Y=Y-25
3B  130 F1=INT(F/256)
24  135 F2=F-F1*256
E2  140 FORI=0TO2
99  145 IFVO(I)=0THENPOKEV+I*7,0
```

```
    :POKEV+I*7+1,0:GOTO180
C3  150 POKEV+I*7+4,0
88  155 POKEV+I*7+4,W(I)*16+RM(I
    )*4+SY(I)*2+1
94  160 IFRM=1THENPOKEV+4,W(0)*1
    6+4
2A  165 POKEV+I*7,F2
E7  170 IFF1>255ORF1<0THEN180
C4  175 POKEV+I*7+1,F1
7F  180 NEXTI
19  181 POKES+1,Y:POKES,X
D3  185 Z=F
5C  190 GOTO25
FF  195 FORI=0TO2
07  200 POKEV+I*7,0
21  205 POKEV+I*7+1,0
39  210 POKEV+I*7+4,W(I)*16
9E  215 NEXTI
B2  220 GOTO25
FB  225 F=F-1
C8  230 FORI=0TO2
F7  235 VO(I)=(FAND2↑I)/2↑I
4D  240 NEXTI:PRINT"[HOME]"CD$"[
    DOWN3]"TAB(34)"[SPC6]";
E2  241 A=0:FORI=0TO2
9D  242 IFVO(I)=1THENPRINT"[HOME
    ]"CD$"[DOWN3]"TAB(34+A);"[RV
    SON]"I+1"[RVSOFF]":A=A+2
71  243 NEXT
9B  245 GOTO25
8D  250 PRINT"[CLR]";:POKES+21,0
    :FORI=0TO2:POKEV+I*7+4,0:NEX
    T
C1  255 PRINT"[SPC11,SV]OICE 1[S
    PC4,SV]OICE 2[SPC4,SV]OICE 3
    ";
4E  260 POKE198,0
DF  265 PRINT"[DOWN,SW]/LENGTH";
    TAB(11);W$(0);TAB(22);W$(1);
    TAB(33);W$(2)
76  270 PRINT"[SA]TT/[SD]EC";TAB
    (12);AD(0);TAB(23);AD(1);TAB
    (34);AD(2)
80  275 PRINT"[SS]US/[SR]EL";TAB
    (12);SR(0);TAB(23);SR(1);TAB
    (34);SR(2)
13  280 PRINT"[SP]ULSE [SH]I";TA
    B(12);PH(0);TAB(23);PH(1);TA
    B(34);PH(2)
30  285 PRINT"[SP]ULSE [SL]O";TA
    B(12);PL(0);TAB(23);PL(1);TA
    B(34);PL(2)
60  290 PRINT"[SR]ING [SM]OD";TA
    B(12);RM(0);TAB(23);RM(1);TA
    B(34);RM(2)
65  295 PRINT"[SS]YNCH[SPC3]";TA
    B(12);SY(0);TAB(23);SY(1);TA
    B(34);SY(2)
53  300 PRINT:PRINT"[SD]O YOU WA
    NT TO CHANGE ANYTHING ([SY]
    OR [SN])?";
6A  305 GETCH$:IFCH$="N"THENGOSU
    B2:GOSUB950:GOTO20
AB  310 IFCH$<>"Y"THEN305
54  315 PRINT:PRINT"[SW]HICH VOI
    CE (1, 2 OR 3)?"
87  320 GETVC$:IFVC$=""THEN320
EE  325 IFVC$="1"THENPRINT"[SV]O
    ICE 1":VC=0:GOTO345
EE  330 IFVC$="2"THENPRINT"[SV]O
    ICE 2":VC=1:GOTO345
1A  335 IFVC$="3"THENPRINT"[SV]O
    ICE 3":VC=2:GOTO345
6D  340 GOTO320
4C  345 PRINT:PRINT"[SW]HICH WAV
    ELENGTH ([ST], [SS], [SP] OR
     [SN])?"
72  350 GETWF$:IFWF$=""THEN350
27  355 IFWF$="T"THENPRINT"[ST]R
    IANGLE":W(VC)=1:W$(VC)="[ST]
    RIANGLE":GOTO380
E0  360 IFWF$="S"THENPRINT"[SS]A
    WTOOTH":W(VC)=2:W$(VC)="[SS]
    AWTOOTH":GOTO380
EA  365 IFWF$="P"THENPRINT"[SP]U
    LSE":W(VC)=4:W$(VC)="[SP]ULS
    E":GOTO380
05  370 IFWF$="N"THENPRINT"[SN]O
    ISE":W(VC)=8:W$(VC)="[SN]OIS
    E":GOTO380
41  375 GOTO350
EA  380 INPUT"[SA]TTACK/[SD]ECAY
    [SPC3]";AD(VC):IFAD(VC)<0ORA
    D(VC)>255THENPRINT"[UP2]":GO
    TO380
5C  385 INPUT"[SS]USTAIN/[SR]ELE
    ASE";SR(VC):IFSR(VC)<0ORSR(V
    C)>255THENPRINT"[UP2]":GOTO3
    85
1B  390 INPUT"[SP]ULSE [SH]I[SPC
    7]";PH(VC):IFPH(VC)<0ORPH(VC
    )>255THENPRINT"[UP2]":GOTO39
    0
A7  395 INPUT"[SP]ULSE [SL]O[SPC
    7]";PL(VC):IFPL(VC)<0ORPL(VC
    )>255THENPRINT"[UP2]":GOTO39
    5
11  400 INPUT"[SR]ING [SM]OD[SPC
    7]";RM(VC):IFRM(VC)<0ORRM(VC
    )>1THENPRINT"[UP2]":GOTO400
A9  405 INPUT"[SS]YNCH[SPC10]";S
    Y(VC):IFSY(VC)<0ORSY(VC)>1TH
    ENPRINT"[UP2]":GOTO405
A1  410 GOTO250
2E  415 RETURN
DD  420 FORI=0TO2
0D  425 IFVO(I)=0THEN435
DA  430 POKEV+I*7+4,0
7F  435 NEXTI
E7  440 IFPEEK(197)=64THEN420
5C  445 GOTO25
54  446 FORI=0TO2:POKEV+I*7+4,0
CF  447 POKEV+I*7+4,W(I)*16+RM(I
    )*4+SY(I)*2+1
8C  448 NEXTI
48  449 GOTO25
68  450 W(0)=1:POKEV+4,W(0)*16+5
    :VO(2)=1:GOTO25
ED  455 IFGR>0ANDZ<>FANDVO(0)=1T
    HEN457
73  456 GOTO120
A1  457 IFZ>FTHENFR=-1:GOTO465
A0  460 FR=1
08  465 FORI=ZTOFSTEPFR*GR*64
67  470 F1=INT(I/256)
64  475 F2=I-F1*256
C2  480 IFRM=1THENPOKEV+4,W(0)*1
    6+5
03  485 POKEV,F2
AE  490 IFF1>255ORF1<0THEN500
9B  495 POKEV+1,F1
D2  500 NEXTI:Z=I:GOTO130
6A  700 IFPS=1THENONK-2GOTO780,7
    50,730,760
A7  701 ONK-2GOTO770,710,720,740
62  710 F(0)=8779*(4/OC):F(1)=11
    060*(4/OC):F(2)=13153*(4/OC)
5F  711 FORI=0TO2:POKEV+I*7+4,0:
    POKEV+I*7+4,33
34  712 F1=INT(F(I)/256):F2=F(I)
    -F1*256
7C  713 IFF1<256THENPOKEV+I*7,F2
    :POKEV+1+I*7,F1
87  714 NEXTI
43  715 GOTO25
4E  720 F(0)=11060*(4/OC):F(1)=1
    3153*(4/OC):F(2)=16572*(4/OC
    )
D1  721 GOTO711
D5  730 F(0)=11718*(4/OC):F(1)=1
    4764*(4/OC):F(2)=17557*(4/OC
    )
EB  731 GOTO711
65  740 F(0)=13153*(4/OC):F(1)=1
    6572*(4/OC):F(2)=19708*(4/OC
    )
C5  741 GOTO711
E4  750 F(0)=9854*(4/OC):F(1)=11
    718*(4/OC):F(2)=14764*(4/OC)
CF  751 GOTO711
E9  760 F(0)=14764*(4/OC):F(1)=1
    7557*(4/OC):F(2)=22121*(4/OC
    )
C9  761 GOTO711
07  770 F(0)=16572*(4/OC):F(1)=1
    9708*(4/OC):F(2)=23436*(4/OC
    )
28  771 GOTO711
45  780 F(0)=17557*(4/OC):F(1)=2
    2121*(4/OC):F(2)=26306*(4/OC
    )
12  781 GOTO711
D7  800 POKES+21,0:PRINT"[CLR,SF
    ]ILTER [SS]ETTINGS"
6E  801 PRINT:PRINT
07  808 FORI=0TO2
7A  810 PRINT"[SF]ILTER FOR VOIC
    E"I+1"IS "GL$(FI(I))
AD  812 NEXT
85  814 PRINT:PRINT"[SC]HANGE AN
    Y ([SY] OR [SN])?"
38  816 POKE198,0
59  818 GETCH$:IFCH$="N"THEN829
AE  820 IFCH$<>"Y"THEN818
C8  821 PRINT:PRINT"[SW]HICH VOI
    CE (1, 2 OR 3)?"
62  822 POKE198,0
91  823 GETWV$:IFWV$="1"THENFI(0
    )=1-FI(0):GOTO828
D7  824 IFWV$="2"THENFI(1)=1-FI(
    1):GOTO828
3B  825 IFWV$="3"THENFI(2)=1-FI(
    2):GOTO828
11  826 GOTO823
58  828 A=0:FORI=0TO2:A=A+FI(I)*
    2↑I:NEXT:POKE54295,A:GOTO800
0E  829 PRINT:PRINT"[SF]ILTER TY
    PE-"TY$
B3  830 PRINT"[SS]ELECT FILTER T
    YPE ([SH]IGH PASS, [SL]OW [S
    P]ASS,[SB]AND PASS, [SN]OTCH
     [SR]EJECT-[SH]/[SL]/[SB]/[S
    N])?
8B  831 POKE198,0
96  832 GETFT$:IFFT$="H"THENPOKE
    54296,79:PRINT"[SH]IGH PASS"
    :TY$="[SH]IGH PASS":GOTO840
07  833 IFFT$="B"THENPOKE54296,4
    7:PRINT"[SB]AND PASS":TY$="[
    SB]AND PASS":GOTO840
FD  834 IFFT$="L"THENPOKE54296,3
    1:PRINT"[SL]OW PASS":TY$="[S
    L]OW PASS":GOTO840
79  835 IFFT$="N"THENPOKE54296,8
    7:PRINT"[SN]OTCH [SR]EJECT":
    TY$="[SN]OTCH [SR]EJECT":GOT
    O840
67  836 GOTO832
AA  840 PRINT:PRINT"[SR]ESONANCE
     ="RF
40  841 INPUT"[SE]NTER RESONANCE
     (0-31)[SPC8,LEFT8]";RF
2E  842 IFRF<0ORRF>31THENPRINT"[
    UP2]":GOTO841
DB  843 A=0:FORI=0TO2:A=A+FI(I)*
    2↑I:NEXT:POKE54295,A+(RF*8)
4C  850 PRINT:PRINT"[SC]UTOFF [S
    F]REQUENCY ="CF
```

```
OB   851 INPUT"[SE]NTER [SC]UTOFF
      [SF]REQUENCY (0-2047)[SPC8,
     LEFT8]";CF
E4   852 IFCF<0ORCF>2047THENPRINT
     "[UP2]":GOTO851
91   854 CL=INT(CF/256):CH=CF-CL*
     256:POKE54293,CL:POKE54294,C
     H
FC   856 PRINT:PRINT"[SA]NY FURTH
     ER CHANGES ([SY] OR [SN])?"
28   857 GETCH$:IFCH$="N"THENGOSU
     B2:GOSUB950:GOTO20
CD   858 IFCH$="Y"THEN800
71   859 GOTO857
12   900 A=0:OZ=OC:FORI=0TO5:IFOC
     /2=INT(OC/2)THENA=A+1:OC=OC/
     2
OB   902 NEXT
FA   904 A=5-A:OC=OZ
2C   906 PRINT"[HOME]"CD$"[UP4]"T
     AB(36)"[RVSON,SC]"A"[RVSOFF]
     ";:GOTO25
97   950 PRINT"[HOME]"CD$"[UP2]"T
     AB(36)"[RVSON]"GL$(GL)"[RVSO
     FF]";
2A   951 PRINT"[HOME]"CD$TAB(36)"
     [RVSON]"GR"[RVSOFF]";
41   952 PRINT"[HOME]"CD$"[DOWN3]
     "TAB(34)"[SPC6]";
19   953 A=0:FORI=0TO2
D6   954 IFVO(I)=1THENPRINT"[HOME
     ]"CD$"[DOWN3]"TAB(34+A);"[RV
     SON]"I+1"[RVSOFF]":A=A+2
3C   955 NEXT
16   960 A=0:OZ=OC:FORI=0TO5:IFOC
     /2=INT(OC/2)THENA=A+1:OC=OC/
     2
47   962 NEXT
06   964 A=5-A:OC=OZ
AA   966 PRINT"[HOME]"CD$"[UP4]"T
     AB(36)"[RVSON,SC]"A"[RVSOFF]
     ";
10   970 POKE53265,27:RETURN
BB   20000 DIMX(64),Y(64)
6B   20002 FORI=1TO64:READX(I),Y(
     I):NEXT
73   20004 CD$="[DOWN16]"
56   20005 GL$(0)="OFF":GL$(1)="O
     N "
FA   20006 RETURN
F5   21000 DATA0,0,0,0,0,0,0,0,0,
     0,0,0,0,0,0,0
05   21002 DATA43,90,43,155,0,0,5
     9,220,59,155,59,90
DA   21004 DATA0,0,0,0,75,90,75,1
     55,0,0,91,220,91,155
52   21006 DATA91,90,75,220,0,0,1
     07,90,107,155,0,0,123,220
EF   21008 DATA123,155,123,90,107
     ,220,0,0,0,0,139,155,0,0
D9   21010 DATA155,220,0,0,0,0,13
     9,220,0,0,0,0,0,0,0,0
89   21012 DATA0,0,0,0,0,0,0,0,0,
     0,0,0,0,0,0,0,0,0,0,0
5F   21014 DATA0,0,0,0,0,0,0,0,0,
     0,0,0,0,0,0,0,27,90,0,0,0,0
8B   30000 DATA 13 ,1, 0 , 7 , 9
90   30001 DATA0,84,0,1,117,0,5
8F   30002 DATA253,64,23,255,80,3
     1,255
64   30003 DATA208,95,255,212,125
     ,117,212
C8   30004 DATA119,119,116,117,11
     7,116,127
B0   30005 DATA255,244,127,223,24
     4,119,223
9B   30006 DATA116,119,223,116,11
     7,253,116
0F   30007 DATA93,85,212,31,87,20
     8,23
E3   30008 DATA255,80,5,253,64,1,
     117
3D   30009 DATA0,0,84,0,0,0,0,0
2D   40000 PRINT"[CLR]";
F6   40001 S=53248
69   40002 READA1,A2,A3,A4,A5
F4   40004 POKES+28,A2:POKE2040,A
     1:POKES+37,A3:POKES+38,A4:PO
     KES+39,A5
79   40005 POKES+40,A5:POKES+41,A
     5:POKE2041,A1:POKE2042,A1
92   40006 FORI=0TO63:READA:POKEA
     1*64+I,A:NEXT
9B   40008 POKES,0:POKES+1,0:RETU
     RN
90   50000 DATA0,-1,0,0,0,0,0,0
3C   50002 DATA4,9854,4389,5,2195
     ,4927
41   50004 DATA11060,0,6,11718,55
     30,7,2765,5859
58   50006 DATA13153,2463,8,14764
     ,6577,0,3288,7382
B4   50008 DATA16572,2930,0,0,828
     6,1,4143,0
01   50010 DATA0,3691,0,0,0,0,0,0
     ,0,0,0,0,0
AD   50012 DATA0,0,0,0,0,2,0,0,3,
     0
79   50014 DATA0,8779,0,0
5F   50016 FORI=0TO2
A3   50018 READW(I),AD(I),SR(I),P
     H(I),PL(I),W$(I),RM(I),SY(I)

A5   50020 NEXT
F1   50022 DATA1,0,240,0,0,"[ST]R
     IANGLE",1,1
46   50024 DATA2,9,240,0,0,"[SS]A
     WTOOTH",1,1
6C   50026 DATA4,9,240,0,255,"[SP
     ]ULSE",1,1
03   50028 FORI=0TO2
84   50030 POKEV+7*I+4,W(I)+RM(I)
     +SY(I)
70   50032 POKEV+7*I+5,AD(I):POKE
     V+7*I+6,SR(I)
7E   50034 POKEV+7*I+3,PH(I):POKE
     V+7*I+2,PL(I)
B5   50036 NEXT
66   50038 POKEV+24,15
B5   50040 RETURN
C2   60000 V=54272:VO(0)=1:VO(1)=
     1:VO(2)=1:OC=4:DIMN(64):TY$=
     "[SN]ONE SET"
8C   60002 FORI=0TO64:READA
79   60004 N(I)=A
D2   60006 NEXT
2F   60008 GOSUB50016:RETURN
```

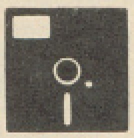
DIY PARALLEL INTERFACE



PROGRAM:PARALLEL

```
48   100 DATA76,6,203,76,55,203,1
     69,66,854
22   110 DATA141,38,3,169,203,141
     ,39,3,737
2D   120 DATA169,1,141,252,203,16
     9,60,141,1136
59   130 DATA253,203,169,0,141,25
     4,203,169,1392
63   140 DATA1,141,1,221,169,255,
     141,3,932
A7   150 DATA221,173,2,221,41,251
     ,141,2,1052
56   160 DATA221,169,0,141,255,20
     3,96,169,1254
C6   170 DATA202,141,38,3,169,241
     ,141,39,974
82   180 DATA3,96,72,165,154,201,
     4,240,935
DD   190 DATA4,104,70,202,241,104
     ,72,41,844
33   200 DATA127,201,13,240,14,44
     ,255,203,1097
27   210 DATA48,4,201,32,144,3,32
     ,175,639
5C   220 DATA203,104,96,32,175,20
     3,238,252,1303
6C   230 DATA203,173,253,203,240,
     35,205,252,1564
56   240 DATA203,176,35,169,10,32
     ,175,203,1003
CF   250 DATA169,10,32,175,203,16
     9,10,32,800
EF   260 DATA175,203,169,10,32,17
     5,203,169,1136
55   270 DATA10,32,175,203,169,10
     ,32,175,806
29   280 DATA203,169,1,141,252,20
     3,169,10,1148
8B   290 DATA32,175,203,173,254,2
     03,240,12,1292
50   300 DATA72,169,32,32,175,203
     ,104,56,843
73   310 DATA233,1,208,244,104,24
     ,96,10,920
F2   320 DATA141,251,203,173,0,22
     1,41,4,1034
D2   330 DATA208,249,24,173,251,2
     03,105,1,1214
B0   340 DATA141,1,221,173,251,20
     3,141,1,1132
30   350 DATA221,24,105,1,141,1,2
     21,96,810
34   360 L=100:FORI=51968TO52175S
     TEP8
13   370 ZZ=0:FORJ=0TO7:READZ:ZZ=
     ZZ+Z:POKEI+J,Z:NEXTJ:READZ
45   380 IFZ<>ZZTHENPRINT"DATA ER
     ROR IN LINE"L:END
A5   390 L=L+10:NEXTI:END
```

CP/M CENTRONICS INTERFACE



PROGRAM: LISTING 1

```
0 BANK1
10 D=32768:L=1000
30 FORX=1TO8
40 READA:IFA=-1THEN90
50 POKED,A:D=D+1:T=T+A
60 NEXT
70 READA:IFA=-1THEN90:ELSEIFT<>A
THENPRINT"ERROR IN LINE ";L:END
80 L=L+10:GOTO20
90 IFD<>33407THENPRINT"ADDRESS E
```

```
RROR":END
100 STOP
1000 DATA201,128,0,210,0,0,0,0,5
30
1010 DATA0,0,0,0,0,0,0,1,1
1020 DATA128,1,217,0,0,0,67,69,4
82
1030 DATA78,84,32,32,32,32,0,0,2
90
1040 DATA0,0,0,0,0,0,0,0,0
1050 DATA0,0,0,0,0,0,0,0,0
1060 DATA0,0,0,0,0,0,0,0,0
1070 DATA0,0,0,0,0,0,0,0,0
1080 DATA0,0,0,0,0,0,0,0,0
1090 DATA0,0,0,0,0,0,0,0,0
1100 DATA0,0,0,0,0,0,0,0,0
1110 DATA0,0,0,0,0,0,0,0,0
1120 DATA0,0,0,0,0,0,0,0,0
1130 DATA0,0,0,0,0,0,0,0,0
1140 DATA0,0,0,0,0,0,0,0,0
1150 DATA0,0,0,0,0,0,0,0,0
1160 DATA0,0,0,0,0,0,0,0,0
1170 DATA0,0,0,0,0,0,0,0,0
1180 DATA0,0,0,0,0,0,0,0,0
1190 DATA0,0,0,0,0,0,0,0,0
1200 DATA0,0,0,0,0,0,0,0,0
1210 DATA0,0,0,0,0,0,0,0,0
1220 DATA0,0,0,0,0,0,0,0,0
1230 DATA0,0,0,0,0,0,0,0,0
1240 DATA0,0,0,0,0,0,0,0,0
1250 DATA0,0,0,0,0,0,0,0,0
1260 DATA0,0,0,0,0,0,0,0,0
1270 DATA0,0,0,0,0,0,0,0,0
1280 DATA0,0,0,0,0,0,0,0,0
1290 DATA0,0,0,0,0,0,0,0,0
1300 DATA0,0,0,0,0,0,0,0,0
1310 DATA0,0,0,0,0,0,0,0,0
1320 DATA201,0,0,0,0,0,0,0,201
1330 DATA0,0,0,0,0,0,0,0,0
1340 DATA0,0,0,0,0,0,0,0,0
1350 DATA0,0,0,0,0,0,0,0,0
1360 DATA0,0,0,0,0,0,0,0,0
1370 DATA0,0,0,0,0,0,0,0,0
1380 DATA0,0,0,0,0,0,0,0,0
1390 DATA0,0,0,0,0,0,0,0,0
1400 DATA0,0,0,0,0,0,0,0,0
1410 DATA0,0,0,0,0,0,0,0,0
1420 DATA0,0,0,0,0,0,0,0,0
1430 DATA0,0,0,0,0,0,0,0,0
1440 DATA0,0,0,0,0,0,0,0,0
1450 DATA0,0,0,0,0,0,0,0,0
1460 DATA0,0,0,0,0,0,0,0,0
1470 DATA0,0,0,0,0,0,0,0,0
1480 DATA0,0,0,0,0,0,195,27,222
1490 DATA1,195,6,0,7,0,0,0,209
1500 DATA67,69,78,84,82,79,85,84
,628
1510 DATA0,0,0,121,254,5,202,41,
623
1520 DATA1,254,112,202,131,1,195
,9,905
1530 DATA1,243,1,13,221,62,16,23
7,794
1540 DATA121,1,2,221,237,120,203
,215,1120
1550 DATA237,121,1,0,221,237,120
,203,1140
1560 DATA215,237,121,1,3,221,237
,120,1155
1570 DATA50,189,1,62,255,237,121
,1,916
1580 DATA1,221,237,120,50,190,1,
237,1057
1590 DATA89,1,0,221,237,120,203,
151,1022
1600 DATA237,121,203,215,237,121
,1,13,1148
1610 DATA221,237,120,203,103,40,
1,1175
1620 DATA1,221,58,190,1,237,121,
1,830
1630 DATA3,221,58,189,1,237,121,
251,1081
1640 DATA62,0,201,237,115,191,1,
49,856
1650 DATA213,1,26,111,19,26,103,
19,518
1660 DATA26,50,215,1,19,26,50,21
6,603
1670 DATA1,237,75,0,0,62,0,185,5
60
1680 DATA194,167,1,184,202,184,1
,94,1027
1690 DATA205,41,35,237,75,215,1,
810
1700 DATA11,237,67,215,1,242,157
,1,931
1710 DATA237,123,191,1,201,0,0,0
,753
1720 DATA0,0,0,0,0,0,0,0,0
1730 DATA0,0,0,0,0,0,0,0,0
1740 DATA0,0,0,0,0,0,0,0,0
1750 DATA0,0,128,0,0,132,128,0,3
88
1760 DATA0,0,32,2,0,0,0,8,42
1770 DATA8,2,64,16,128,34,33,9,2
94
1780 DATA16,0,0,0,0,26,26,26,94
1790 DATA26,26,26,26,26,26,26,26
,-1
```

PROGRAM: LISTING 2

```
RSX Module for providing a CENTRONICS printer output from the user
port.

;Traps BDOS call 5 in reg C and Character in E

;Z80 routines library

        maclib  Z80

;Some Addresses

pa          equu        Odd00h          ;Port A
pb          equ         Odd01h          ;Port b
ddra        equ         Odd02h          ;data direction register a
ddrb        equ         Odd03h          ;data direction register b
icr         equ         Odd0dh          ;interupt control register

;RSX Start Block

            cseg                        ;code

            db          0,0,0,0,0,0     ;serial number space
            jmp         start           ;program start
next:       db          0c3h            ;jmp instruction
            dw          0
prev:       dw          0
remove:     db          0               ;clear remove flag
nonbnk:     db          0               ; either version of cp/m
            db          'centrout'      ;8 byte name
            db          0,0,0

;Start main program

start       mov         a,c
            cpi         5               ;bdos 5?
            jz          centout         ;output single character
            cpi         112             ;bdos 112?
            jz          list            ;output list of characters
            jmp         next            ;jump to next rsx or bdos

;output character to user port configured as centronics

centout     di                          ;disable irq

            lxi         b,icr           ;point to icr
            mvi         a,10000b

                outp        a               ;disable flag nmi

    ;set up user port

                lxi         b,ddra          ;point to strobe ddr
                inp         a               ;get ddra
                setb        2,a
                outp        a               ;set bit 2 pa to output
                ixi         b,pa            ;point to strobe
                inp         a               ;get pa
                setb        2,a
                outp        a               ;set bit 2 pa high
                lxi         b,ddrb          ;point to ddrb
```

```
        inp     a               ;get it
        sta     ddrbst          ;and store it
        mvi     a,0ffh
        outp    a               ;set pb to output
        dseg
ddrbst  db      0               ;ddrb store
        cseg
;output data
        lxi     b,pb
        inp     a               ;get old contents
        sta     post
        outp    e               ;set up data
        lxi     b,pa
        inp     a
        res     2,a             ;strobe low
        outp    a
        setb    2,a             ;strobe high
        outp    a
        lxi     b,icr           ;point to icr
loop    inp     a               ;read icr
        bit     4,a             ;test acknowledge
        jrz     loop            ;loop until acknowledge

        dseg
pbst    db      0               ;pb store
        cseg

        lxi     b,pb            ;point to pb
        lda     pbst
        outp    a               ;restore contents of pb
        lxi     b,ddrb          ;point to ddrb
        lda     ddrbst
        outp    a               ;restore ddrb

;no errors

        ei                      ;enable irq
        mvi     a,0
        ret

;output list of characters

list    sspd    yourst          ;store stack
        lxi     sp,myst         ;get stack
        ldax    d
        mov     l,a             ;get low byte of string pointer
        inx     d
        ldax    d               ;get high byte of string pointer
        mov     h,a
        inx     d
        ldax    d               ;get low byte of string length
        sta     length
        inx     d
        ldax    d               ;get high byte of string length
        sta     length+1

        dseg
yourst  dw      0               ;storage for old stack pointer
        ds      20
myst    dw      0               ;new stack
length  dw      0               ;string length
        cseg

        ibcd    b,length        ;get string length

list0   mvi     a,0
        cmp     c
        jnz     list1           ;continue if low byte not zero
        cmp     b
        jz      list2           ;finish if high byte not zero

list1   mov     e,m             ;get character from list
        call    centout
        inx     n               ;increment pointer
        ibcd    length          ;get length counter
        dcx     bc              ;decrement
        sbcd    length          ;and restore
        jp      listu

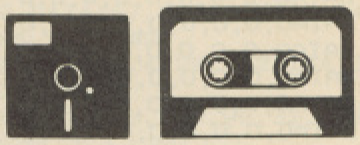
list2   lspd    yourst          ;get stack pointer back
        ret

        end
```

PROGRAM: LISTING 3

```
era $1.com
era $1.rsx
rmac $1
link $1 [op]
ren $1.rsx=$1.pr1
gencom $1 [null]
```

CASSETTE INLAY PRINTER

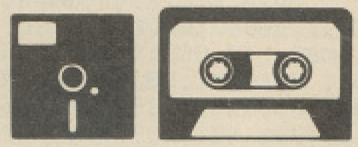


PROGRAM: INLAY PRINTER

```
85  0 REM ***********************
    ***
8E  1 REM
1F  2 REM CASSETTE CARD INSERTS
1F  3 REM BY MICK WALPOLE
8B  4 REM
80  5 REM ***********************
    ***
3C  6 :
D4  7 DIMAD$(9):DIMBD$(9)
33  9 :
E9  10 POKE53280,14:POKE53281,14
83  20 PRINT"[CLR,WHITE,RVSON,SU
    ,S*30,SI]"
04  30 PRINT"[RVSON,S-] CASSETTE
     CARD INSERT PRINTER [S-]"
05  40 PRINT"[RVSON,S-] --------
    -------------------- [S-]"
64  50 PRINT"[RVSON,S-,SPC7]BY
    MICK WALPOLE[SPC7,S-]"
F6  60 PRINT"[RVSON,SJ,S*30,SK]"
51  100 GOSUB6020
26  200 PRINT"[HOME,DOWN8,RVSON]
    ";TAB(21);"MENU"
9A  210 PRINTTAB(21);"[DOWN]1. C
    ASSETTE NUMBER"
EB  220 PRINTTAB(21);"[DOWN]2. C
    ASSETTE NAME"
69  230 PRINTTAB(21);"[DOWN]3. S
    IDE A DETAILS"
89  240 PRINTTAB(21);"[DOWN]4. S
    IDE B DETAILS"
F9  250 PRINTTAB(21);"[DOWN]5. P
    RINT INSERT"
D6  260 PRINTTAB(21);"[DOWN,RVSO
    N]ENTER 1 - 5"
FC  270 PRINTTAB(21);"[DOWN,BLAC
    K]DETAILS 1-4 MUST"
4E  280 PRINTTAB(21);"[BLACK]ALL
     BE ENTERED  [WHITE]"
6B  300 GETA$:IFA$=""THEN300
1E  310 IFA$="1"THEN1000
7C  320 IFA$="2"THEN2000
B2  330 IFA$="3"THEN3000
4C  340 IFA$="4"THEN4000
7E  350 IFA$="5"THEN5000
A5  360 IFA$="\"THENPRINT"[CLR]H
    ELLO MICK...":POKE808,237:ST
    OP
4D  370 GOTO300
29  1000 REM *** CASSETTE NUMBER
     ***
C3  1010 PRINT"[CLR]1. CASSETTE
    NUMBER"
F8  1020 GOSUB6000
```

```
61   1025 FORX=0TO300:NEXTX
89   1030 PRINT"[HOME,DOWN3,RIGHT
     13,BLACK]TAPE88[HOME]"
29   1040 PRINT"[HOME,WHITE,DOWN2
     0]ENTER CASSETTE"
70   1050 PRINT"NUMBER:[SPC7]"
BE   1060 INPUTCN
B5   1070 IFCN>99THEN1000
36   1075 AA=1
D7   1080 GOTO20
46   1999 STOP
D9   2000 REM *** CASSETTE NAME *
     **
36   2010 PRINT"[CLR]2. CASSETTE
     NAME"
EC   2020 GOSUB6000
42   2025 FORX=0TO300:NEXTX
40   2026 PRINT"[HOME]"TAB(4)"[DO
     WN3,BLACK]X"
08   2030 FORX=0TO13
BE   2040 PRINTTAB(4)"X"
E0   2050 NEXTX
29   2060 PRINT"[HOME,WHITE,DOWN2
     0]ENTER CASSETTE"
B2   2070 PRINT"NAME:"
E2   2080 INPUTCN$
C3   2090 L=LEN(CN$):IFL>23THEN20
     00
B3   2100 SV$="[SPC23]"
65   2110 CN$=CN$+RIGHT$(SV$,23-L
     )
2A   2115 BB=1
3B   2120 GOTO20
52   2999 STOP
4A   3000 REM *** SIDE A DETAILS
     ***
D6   3010 PRINT"[CLR]3. SIDE A DE
     TAILS"
E0   3020 GOSUB6000
C6   3025 FORX=0TO300:NEXTX
2E   3030 PRINT"[HOME,DOWN3,BLACK
     ]"
39   3040 FORX=0TO5
14   3050 PRINTTAB(6)"[RVSON,SPC1
     0]"
D5   3060 NEXTX
60   3070 FORX=1TO9
C4   3080 PRINT"[HOME,WHITE,DOWN2
     0]ENTER";X;"DETAIL"
C5   3090 INPUTAD$(X)
A8   3095 L=LEN(AD$(X)):IFL>24THE
     N3300
64   3100 PRINT"[UP,SPC34]"
08   3110 NEXTX
36   3115 CC=1
07   3200 GOTO20
91   3300 PRINT"[BLACK]TOO MANY C
     HARACTERS[WHITE]":FORT=0TO50
     0:NEXTT
87   3310 PRINT"[UP2,SPC34]"
C1   3320 PRINT"[SPC35]"
F1   3330 GOTO3080
3E   3999 STOP
27   4000 REM *** SIDE B DETAILS
     ***
12   4010 PRINT"[CLR]4. SIDE B DE
     TAILS"
D4   4020 GOSUB6000
BA   4025 FORX=0TO300:NEXTX
32   4030 PRINT"[HOME,DOWN11,BLAC
     K]"
1D   4040 FORX=0TO5
48   4050 PRINTTAB(6)"[RVSON,SPC1
     0]"
C1   4060 NEXTX
44   4070 FORX=1TO9
C3   4080 PRINT"[HOME,WHITE,DOWN2
     0]ENTER";X;"DETAIL"
F7   4090 INPUTBD$(X)
83   4095 L=LEN(BD$(X)):IFL>24THE
     N4300
A0   4100 PRINT"[UP,SPC34]"
F4   4110 NEXTX
4A   4115 DD=1
13   4200 GOTO20
A5   4300 PRINT"[BLACK]TOO MANY C
     HARACTERS[WHITE]":FORT=0TO50
     0:NEXTT
23   4310 PRINT"[UP2,SPC34]"
0D   4320 PRINT"[SPC35]"
FF   4330 GOTO4080
0A   4999 STOP
C0   5000 REM *** PRINT INSERT **
     *
4E   5010 PRINT"[CLR]5. PRINT INS
     ERT"
0B   5020 PRINT"[DOWN2,RVSON]HAVE
      YOU PUT IN ALL THESE DETAIL
     S:"
EB   5030 PRINT"[DOWN,SPC5]1. CAS
     SETTE NUMBER"
B8   5040 PRINT"[DOWN,SPC5]2. CAS
     SETTE NAME"
76   5050 PRINT"[DOWN,SPC5]3. SID
     E A DETAILS"
76   5060 PRINT"[DOWN,SPC5]4. SID
     E B DETAILS"
AB   5065 PRINT"[DOWN,RVSON]YES/N
     O"
BF   5070 PRINT"[DOWN,RVSON,BLACK
     ]MAKE SURE THE PRINTER IS CO
     NNECTED[WHITE]"
07   5080 GETA$:IFA$=""THEN5080
A4   5090 IFA$="N"THEN20
FB   5095 GOSUB5700
95   5100 REM *** PRINTOUT ROUTIN
     E ***
0C   5110 D$=CHR$(14):S$=CHR$(15)
     :TB$=CHR$(16)
15   5120 IFCN<10THENSS$=" "
7E   5125 IFCN>=10THENSS$=""
CC   5130 OPEN3,4
93   5200 PRINT#3,S$;"[CA,S*9,CR,
     S*4,CR,S*24,CS]"
15   5210 PRINT#3,"[SPC10,S-] "D$
     ;LEFT$(CN$,1);S$;
74   5220 PRINT#3," [S-]SIDE A[SP
     C4]";D$;"TAPE"+SS$;CN;S$
49   5230 PRINT#3,"[SPC10,S-] "D$
     ;MID$(CN$,2,1);S$;
A8   5240 PRINT#3," [S-]"
E8   5245 FORX=1TO9
27   5250 PRINT#3,"[SPC10,S-] "D$
     ;MID$(CN$,X+2,1);S$;
7F   5260 PRINT#3," [S-]";AD$(X)
80   5270 NEXTX
CA   5280 PRINT#3,"[SPC10,S-] "D$
     ;MID$(CN$,12,1);S$;
F3   5290 PRINT#3," [CQ,S*24,CW]"
64   5295 PRINT#3,"[SPC10,S-] "D$
     ;MID$(CN$,13,1);S$;
2B   5300 PRINT#3," [S-]SIDE B"
39   5305 PRINT#3,"[SPC10,S-] "D$
     ;MID$(CN$,14,1);S$;
12   5310 PRINT#3," [S-]"
D5   5320 FORX=1TO9
14   5330 PRINT#3,"[SPC10,S-] "D$
     ;MID$(CN$,X+14,1);S$;
0E   5340 PRINT#3," [S-]";BD$(X)
D0   5350 NEXTX
3A   5400 PRINT#3,S$;"[CZ,S*9,CE,
     S*4,CE,S*24,CX]"
95   5500 PRINT#3:CLOSE3
8E   5510 FORX=1TO9
6E   5520 AD$(X)="":BD$(X)=""
85   5530 NEXTX
7B   5540 AA=0:BB=0:CC=0:DD=0
9E   5600 GOTO20
88   5700 REM *** CHECKER ***
BF   5710 IFAA<>1THENPRINT"[DOWN,
     BLACK]YOU HAVE NOT ENTERED A
      CASSETTE NUMBER[WHITE]"
C5   5720 IFBB<>1THENPRINT"[DOWN,
     BLACK]YOU HAVE NOT ENTERED T
     HE CASSETTE NAME[WHITE]"
9F   5730 IFCC<>1THENPRINT"[DOWN,
     BLACK]YOU HAVE NOT ENTERED S
     IDE A DETAILS[WHITE]"
82   5740 IFDD<>1THENPRINT"[DOWN,
     BLACK]YOU HAVE NOT ENTERED S
     IDE B DETAILS[WHITE]"
99   5750 IFAA=1ANDBB=1ANDCC=1AND
     DD=1THENRETURN
AD   5760 GOSUB5800:GOTO20
87   5800 FORT=0TO2000:NEXTT
46   5810 RETURN
16   5999 STOP
78   6000 REM *** SCREEN CARD ROU
     TINE ***
AB   6010 :
ED   6020 PRINT"[DOWN,CA,S*2,CR,S
     *,CR,S*13,CS]"
4C   6030 PRINT"[S-,SSPC2,S-]X[S-
     ]SIDEA  TAPE88[S-]"
F5   6040 FORX=0TO5
5C   6050 PRINT"[S-,SSPC2,S-]X[S-
     ,RVSON,SPC13,RVSOFF,S-]"
99   6060 NEXTX
3F   6070 PRINT"[S-,SSPC2,S-]X[S-
     ]-------------[S-]"
03   6080 PRINT"[S-,SSPC2,S-]X[S-
     ]SIDEB[SPC8,S-]"
D3   6090 FORX=0TO5
FA   6100 PRINT"[S-,SSPC2,S-]X[S-
     ,RVSON,SPC13,RVSOFF,S-]"
CF   6110 NEXTX
E6   6120 PRINT"[CZ,S*2,CE,S*,CE,
     S*13,CX]"
87   6130 RETURN
```

MAY I INTERRUPT



PROGRAM: MAY I INTERRUPT

```
0C   10 BL=3    :LN=50   :SA=4827
     9
5B   20 FOR L=0 TO BL:CX=0:FOR D=
     0 TO 15:READ A:CX=CX+A:POKE
     SA+L*16+D,A:NEXT D
A5   30 READ A:IF A><CX THENPRINT
     "ERROR IN LINE";LN+(L*10):ST
     OP
86   40 NEXT L
61   50 DATA 67,72,82,36,40,50,55
     ,41,59,67,72,82,36,40,54,54,
     907
F0   60 DATA 41,59,67,72,82,36,40
     ,52,41,67,72,82,36,40,50,55,
     892
1B   70 DATA 41,59,67,72,82,36,40
     ,49,49,50,41,59,67,72,82,36,
     902
8B   80 DATA 40,49,41,0,0,0,0,0,0
     ,0,0,0,0,0,0,0,130
D2   90 BL=1    :LN=130   :SA=4836
     0
2B   100 FOR L=0 TO BL:CX=0:FOR D
     =0 TO 15:READ A:CX=CX+A:POKE
      SA+L*16+D,A:NEXT D
55   110 READ A:IF A><CX THENPRIN
     T"ERROR IN LINE";LN+(L*10):S
     TOP
56   120 NEXT L
```

```
1D  130 DATA 34,79,80,69,78,52,4
    4,52,58,80,82,73,78,84,35,52
    ,1030
59  140 DATA 44,34,0,0,0,0,0,0,0
    ,0,0,0,0,0,0,0,78
0C  150 BL=1     :LN=190   :SA=484
    41
87  160 FOR L=0 TO BL:CX=0:FOR D
    =0 TO 15:READ A:CX=CX+A:POKE
     SA+L*16+D,A:NEXT D
81  170 READ A:IF A><CX THENPRIN
    T"ERROR IN LINE";LN+(L*10):S
    TOP
1A  180 NEXT L
DD  190 DATA 67,72,82,36,40,50,5
    5,41,59,67,72,82,36,40,55,55
    ,909
A7  200 DATA 41,59,67,72,82,36,4
    0,52,48,41,0,0,0,0,0,0,538
C5  210 BL=1     :LN=250   :SA=485
    22
83  220 FOR L=0 TO BL:CX=0:FOR D
    =0 TO 15:READ A:CX=CX+A:POKE
     SA+L*16+D,A:NEXT D
AD  230 READ A:IF A><CX THENPRIN
    T"ERROR IN LINE";LN+(L*10):S
    TOP
DE  240 NEXT L
50  250 DATA 67,72,82,36,40,50,5
    5,41,59,67,72,82,36,40,56,49
    ,904
F4  260 DATA 41,59,67,72,82,36,4
    0,51,56,41,0,0,0,0,0,0,545
E2  270 BL=4     :LN=310   :SA=486
    03
28  280 FOR L=0 TO BL:CX=0:FOR D
    =0 TO 15:READ A:CX=CX+A:POKE
     SA+L*16+D,A:NEXT D
94  290 READ A:IF A><CX THENPRIN
    T"ERROR IN LINE";LN+(L*10):S
    TOP
83  300 NEXT L
40  310 DATA 67,72,82,36,40,50,5
    5,41,59,67,72,82,36,40,54,55
    ,908
81  320 DATA 41,59,67,72,82,36,4
    0,54,53,41,67,72,82,36,40,50
    ,892
03  330 DATA 55,41,59,67,72,82,3
    6,40,56,50,41,59,67,72,82,36
    ,915
03  340 DATA 40,51,41,67,72,82,3
    6,40,50,55,41,59,67,72,82,36
    ,891
04  350 DATA 40,55,56,41,59,67,7
    2,82,36,40,51,41,0,0,0,0,640

72  360 BL=1     :LN=400   :SA=486
    84
BE  370 FOR L=0 TO BL:CX=0:FOR D
    =0 TO 15:READ A:CX=CX+A:POKE
     SA+L*16+D,A:NEXT D
A2  380 READ A:IF A><CX THENPRIN
    T"ERROR IN LINE";LN+(L*10):S
    TOP
69  390 NEXT L
54  400 DATA 67,72,82,36,40,50,5
    5,41,59,67,72,82,36,40,54,54
    ,907
D2  410 DATA 41,59,67,72,82,36,4
    0,51,41,0,0,0,0,0,0,0,489
1A  420 BL=3     :LN=460   :SA=487
    65
2A  430 FOR L=0 TO BL:CX=0:FOR D
    =0 TO 15:READ A:CX=CX+A:POKE
     SA+L*16+D,A:NEXT D
BE  440 READ A:IF A><CX THENPRIN
    T"ERROR IN LINE";LN+(L*10):S
    TOP
2D  450 NEXT L
9A  460 DATA 67,72,82,36,40,50,5
    5,41,59,67,72,82,36,40,56,51
    ,906
17  470 DATA 41,59,67,72,82,36,4
    0,52,57,41,67,72,82,36,40,50
    ,894
63  480 DATA 55,41,59,67,72,82,3
    6,40,54,53,41,59,67,72,82,36
    ,916
0D  490 DATA 40,54,41,0,0,0,0,0,
    0,0,0,0,0,0,0,0,135
85  500 BL=1     :LN=540   :SA=488
    46
7A  510 FOR L=0 TO BL:CX=0:FOR D
    =0 TO 15:READ A:CX=CX+A:POKE
     SA+L*16+D,A:NEXT D
E1  520 READ A:IF A><CX THENPRIN
    T"ERROR IN LINE";LN+(L*10):S
    TOP
FA  530 NEXT L
B1  540 DATA 67,72,82,36,40,50,5
    5,41,59,67,72,82,36,40,54,52
    ,905
05  550 DATA 41,0,0,0,0,0,0,0,0,
    0,0,0,0,0,0,0,41
32  560 BL=12    :LN=600   :SA=489
    28
E3  570 FOR L=0 TO BL:CX=0:FOR D
    =0 TO 15:READ A:CX=CX+A:POKE
     SA+L*16+D,A:NEXT D
8D  580 READ A:IF A><CX THENPRIN
    T"ERROR IN LINE";LN+(L*10):S
    TOP
BE  590 NEXT L
E2  600 DATA 125,190,151,188,57,
    189,219,189,206,190,232,188,
    138,189,44,190,2685
42  610 DATA 0,169,1,141,25,208,
    174,141,2,165,197,205,48,191
    ,240,58,1965
E3  620 DATA 141,48,191,56,233,3
    ,201,4,176,48,224,0,240,8,22
    4,4,1801
9D  630 DATA 240,4,202,24,105,4,
    10,168,185,32,191,133,250,20
    0,185,32,1965
50  640 DATA 191,133,251,160,0,1
    38,240,19,32,186,191,177,250
    ,240,11,201,2420
D7  650 DATA 34,240,4,170,32,167
    ,2,200,208,241,96,162,4,160,
    255,32,2007
62  660 DATA 232,2,160,0,177,250
    ,201,67,208,222,32,200,191,1
    36,32,208,2318
4C  670 DATA 191,138,133,252,32,
    208,191,105,10,202,208,251,1
    01,252,133,252,2659
19  680 DATA 32,208,191,105,100,
    202,208,251,101,252,170,32,1
    67,2,32,200,2253
16  690 DATA 191,177,250,208,213
    ,162,13,32,167,2,72,138,72,1
    52,72,32,1953
63  700 DATA 231,255,104,168,104
    ,170,104,96,177,250,200,201,
    41,208,249,96,2654
36  710 DATA 136,177,250,201,40,
    240,8,56,233,48,170,24,169,0
    ,96,104,1952
CB  720 DATA 104,165,252,76,170,
    191,0,0,0,0,0,0,0,0,0,0,958
21  730 BL=5     :LN=770   :SA=679

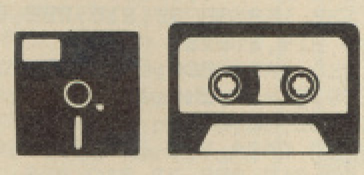
02  740 FOR L=0 TO BL:CX=0:FOR D
    =0 TO 15:READ A:CX=CX+A
C1  741 IF SA+L*16+D<768 THEN PO
    KE SA+L*16+D,A
CE  742 NEXT D
5B  750 READ A:IF A><CX THENPRIN
    T"ERROR IN LINE";LN+(L*10):S
    TOP
8E  760 NEXT L:END
E3  770 DATA 32,181,2,138,32,210
    ,255,165,1,41,254,133,1,96,1
    65,1,1707
5D  780 DATA 9,1,133,1,96,120,16
    9,31,141,13,220,141,13,221,1
    73,13,1495
4F  790 DATA 220,173,13,221,169,
    220,141,20,3,169,2,141,21,3,
    169,1,1686
3C  800 DATA 141,26,208,88,96,32
    ,174,2,32,49,191,32,181,2,76
    ,49,1379
84  810 DATA 234,32,181,2,169,18
    ,32,186,255,169,0,32,189,255
    ,32,192,1978
F7  820 DATA 255,162,18,32,201,2
    55,76,174,2,0,0,0,0,0,0,0,11
    75
```

PROGRAM:KEYMAKER

```
35  10 PRINT"[CLR,DOWN3,RIGHT2]S
    YS49152 TO RESET AFTER RUN/R
    ESTORE"
78  20 BL=24    :LN=50    :SA=4915
    2
29  30 FOR L=0 TO BL:CX=0:FOR D=
    0 TO 15:READ A:CX=CX+A:POKE
    SA+L*16+D,A:NEXT D
73  40 READ A:IF A><CX THENPRINT
    "ERROR IN LINE";LN+(L*10):ST
    OP
75  50 NEXT L:SYS49152
3C  60 DATA 160,0,185,14,192,240
    ,6,153,125,0,200,208,245,96,
    32,240,2096
B5  70 DATA 243,76,21,192,0,201,
    75,240,11,201,58,176,6,56,23
    3,48,1837
5D  80 DATA 56,233,208,96,164,12
    2,136,48,11,185,0,2,201,32,2
    40,246,1980
DE  90 DATA 169,75,208,229,164,1
    22,200,185,0,2,201,69,208,24
    2,200,185,2459
32  100 DATA 0,2,201,89,208,234,
    160,0,169,96,133,128,32,115,
    0,217,1784
61  110 DATA 43,193,208,8,200,19
    2,6,208,243,76,67,193,192,2,
    208,96,2135
07  120 DATA 201,49,144,92,201,5
    7,176,88,41,15,56,233,1,10,1
    68,185,1717
8F  130 DATA 50,193,133,254,200,
    185,50,193,133,255,32,115,0,
    201,61,208,2263
F6  140 DATA 63,162,0,160,255,32
    ,115,0,201,0,240,27,201,34,2
    08,64,1762
6D  150 DATA 32,27,193,145,254,3
    2,115,0,201,0,208,2,169,34,2
    01,34,1647
18  160 DATA 208,238,32,27,193,1
    45,254,32,203,192,169,0,32,2
    7,193,145,2090
A0  170 DATA 254,76,116,164,169,
    0,145,254,32,203,192,162,23,
    76,55,164,2085
DA  180 DATA 32,27,193,162,11,32
    ,203,192,76,55,164,169,76,13
    3,128,96,1749
93  190 DATA 32,18,193,72,162,0,
    189,37,193,240,8,32,27,193,1
    45,254,1795
55  200 DATA 232,208,243,104,32,
    27,193,145,254,32,115,0,201,
    0,240,10,2036
65  210 DATA 201,44,240,6,32,18,
    193,76,228,192,170,169,41,32
```

```
            ,27,193,1862
29   220 DATA 145,254,138,240,162
     ,32,27,193,169,59,145,254,32
     ,115,0,76,2041
DC   230 DATA 208,192,201,48,144,
     170,201,58,176,166,96,200,19
     2,81,48,4,2185
6F   240 DATA 160,0,16,144,96,67,
     72,82,36,40,0,69,89,76,73,83
     ,1103
A8   250 DATA 84,0,151,188,232,18
     8,57,189,138,189,219,189,44,
     190,125,190,2373
AE   260 DATA 206,190,0,165,1,41,
     254,133,1,162,0,169,13,32,21
     0,255,1832
50   270 DATA 189,50,193,240,44,1
     33,254,232,189,50,193,133,25
     5,232,160,0,2547
C5   280 DATA 169,70,32,210,255,1
     38,74,24,105,48,32,210,255,1
     69,61,32,1884
36   290 DATA 210,255,169,32,32,2
     10,255,177,254,240,208,32,21
     0,255,200,208,2947
5E   300 DATA 246,165,1,9,1,133,1
     ,169,76,133,128,76,116,164,0
     ,0,1418
```

DISKASSEMBLER



```
PROGRAM: DISKASSEMBLER
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```
USE LEFT POINTING ARROW BEFORE
COMMANDS $, L, D
82   10 BL=144   :LN=50    :SA=3277
     7
5B   20 FOR L=0 TO BL:CX=0:FOR D=
     0 TO 15:READ A:CX=CX+A:POKE
     SA+L*16+D,A:NEXT D
A5   30 READ A:IF A><CX THENPRINT
     "ERROR IN LINE";LN+(L*10):ST
     OP
40   40 NEXT L:END
76   50 DATA 160,88,169,160,153,1
     67,2,136,16,250,200,185,98,1
     28,153,124,2189
E2   60 DATA 0,208,247,169,193,13
     3,128,96,201,95,208,48,32,11
     5,0,160,2033
77   70 DATA 0,201,0,208,3,76,60,
     128,217,102,128,240,11,200,1
     90,102,1866
BC   80 DATA 128,208,245,162,11,7
     6,55,164,152,10,168,185,106,
     128,133,254,2185
24   90 DATA 200,185,106,128,133,
     255,32,115,0,108,254,0,201,5
     8,176,8,1959
64   100 DATA 201,32,56,233,48,56
     ,233,208,96,76,33,128,0,36,7
     6,68,1580
97   110 DATA 0,112,128,213,129,1
     54,135,240,3,76,60,128,169,1
     47,32,210,1936
D6   120 DATA 255,169,36,32,210,2
     55,169,0,32,189,255,169,15,3
     2,33,129,1980
62   130 DATA 169,1,162,96,160,16
     3,32,189,255,169,1,162,8,160
     ,0,32,1759
80   140 DATA 186,255,32,192,255,
     162,1,32,198,255,32,207,255,
     32,207,255,2556
07   150 DATA 32,207,255,32,207,2
     55,32,207,255,170,32,207,255
     ,32,205,189,2572
C2   160 DATA 32,207,255,240,5,32
     ,210,255,208,246,169,13,32,2
     10,255,32,2401
03   170 DATA 207,255,240,5,32,21
     6,128,208,218,32,231,255,76,
     116,164,165,2548
82   180 DATA 214,201,20,208,38,1
     60,0,185,42,129,240,6,32,210
     ,255,200,2140
FB   190 DATA 208,245,169,0,133,1
     98,197,198,240,252,133,198,1
     73,119,2,201,2666
79   200 DATA 3,208,3,76,210,128,
     169,147,32,210,255,96,169,18
     ,133,133,1990
A9   210 DATA 169,0,133,134,32,66
     ,129,169,0,32,189,255,169,15
     ,32,33,1557
97   220 DATA 129,32,80,129,200,7
     6,82,129,162,8,168,32,186,25
     5,76,192,1936
79   230 DATA 255,13,32,32,32,32,
     32,18,32,80,82,69,83,83,32,6
     5,972
7F   240 DATA 78,89,32,75,69,89,3
     2,146,0,169,1,162,58,160,160
     ,32,1352
51   250 DATA 189,255,169,2,76,33
     ,129,160,0,162,15,32,201,255
     ,185,221,2084
A8   260 DATA 130,240,6,32,210,25
     5,200,208,245,169,0,192,7,24
     0,12,166,2312
ED   270 DATA 132,132,136,32,205,
     189,164,136,76,204,255,166,1
     33,132,136,32,2260
55   280 DATA 205,189,164,136,169
     ,44,32,210,255,169,0,166,134
     ,132,136,32,2173
E6   290 DATA 205,189,164,136,76,
     204,255,164,135,162,2,32,198
     ,255,32,207,2416
70   300 DATA 255,133,133,32,172,
     129,32,207,255,133,134,32,17
     2,129,132,135,2215
C2   310 DATA 76,204,255,145,127,
     200,208,2,230,128,96,169,193
     ,133,128,169,2463
A3   320 DATA 0,160,6,153,249,0,1
     36,208,250,133,127,141,213,2
     ,141,0,1919
3B   330 DATA 192,141,1,192,169,1
     92,133,253,96,32,115,0,144,2
     51,201,32,2144
AA   340 DATA 240,247,160,0,201,3
     4,240,3,76,60,128,32,115,0,2
     40,12,1788
E1   350 DATA 201,34,240,8,153,16
     7,2,200,192,16,208,239,192,1
     6,240,8,2116
9F   360 DATA 169,160,153,167,2,2
     00,208,244,169,0,153,167,2,1
     33,132,133,2192
37   370 DATA 135,32,180,129,32,5
     ,129,32,144,129,169,144,133,
     132,160,8,1693
FA   380 DATA 32,82,129,162,2,32,
     198,255,160,255,200,32,207,2
     55,153,184,2338
31   390 DATA 2,208,247,133,132,3
     2,204,255,32,80,129,169,5,13
     3,132,160,2053
9F   400 DATA 8,32,82,129,162,2,3
     2,198,255,160,0,32,207,255,2
     17,167,1938
BB   410 DATA 2,208,7,200,201,0,2
     08,243,240,59,170,185,167,2,
     201,42,2135
35   420 DATA 208,15,138,153,167,
     2,200,32,207,255,201,160,208
     ,245,76,142,2409
8B   430 DATA 130,32,204,255,24,1
     65,132,105,32,133,132,144,19
     4,169,0,133,1984
F0   440 DATA 132,160,8,32,82,129
     ,32,144,129,165,133,208,171,
     32,231,255,2043
DA   450 DATA 162,4,76,55,164,32,
     204,255,160,0,185,236,130,20
     0,32,210,2105
8E   460 DATA 255,208,247,56,165,
     132,233,3,133,132,160,8,32,8
     2,129,162,2137
14   470 DATA 2,32,198,255,32,207
     ,255,141,212,2,160,0,132,135
     ,32,144,1939
15   480 DATA 129,165,133,240,14,
     169,0,133,132,32,80,129,200,
     32,82,129,1799
2D   490 DATA 76,183,130,32,231,2
     55,32,132,255,169,0,133,127,
     169,193,133,2250
DB   500 DATA 128,76,116,164,85,4
     9,58,50,44,48,44,0,66,45,80,
     58,1111
AF   510 DATA 50,44,0,13,76,79,65
     ,68,73,78,71,32,84,82,65,67,
     947
CF   520 DATA 75,83,32,65,78,68,3
     2,83,69,67,84,79,82,83,13,0,
     993
1B   530 DATA 160,1,140,214,2,168
     ,141,216,2,185,34,133,133,25
     4,36,254,2073
0A   540 DATA 80,3,238,214,2,16,6
     ,238,214,2,238,214,2,41,63,1
     41,1712
9D   550 DATA 215,2,172,214,2,136
     ,165,253,201,192,208,40,165,
     252,201,254,2672
07   560 DATA 144,52,201,255,208,
     6,192,0,240,44,208,8,192,2,4
     8,38,1838
2D   570 DATA 192,1,208,4,169,0,2
     40,3,173,254,192,141,0,192,1
     73,255,2197
01   580 DATA 192,141,1,192,104,1
     04,24,165,127,105,2,133,127,
     169,0,101,1687
EA   590 DATA 128,133,128,76,198,
     135,165,251,32,244,132,165,2
     50,32,244,132,2445
E7   600 DATA 169,160,32,210,255,
     32,136,135,24,173,215,2,10,1
     09,215,2,1879
0F   610 DATA 170,189,162,134,32,
     210,255,232,189,162,134,32,2
     10,255,232,189,2787
8A   620 DATA 162,134,32,210,255,
     169,32,32,210,255,172,216,2,
     32,188,131,2232
37   630 DATA 24,10,170,189,212,1
     31,133,254,232,189,212,131,1
     33,255,160,0,2435
82   640 DATA 108,254,0,152,24,74
     ,170,189,34,134,170,152,41,1
     ,240,5,1748
B4   650 DATA 138,41,15,16,5,138,
     74,74,74,74,96,247,131,113,1
     32,1,1369
BF   660 DATA 132,24,132,42,132,2
     52,131,87,132,100,132,139,13
     2,63,132,68,1830
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A5  670 DATA 132,123,132,76,132,
    169,160,32,210,255,202,208,2
    50,96,162,10,2349
C7  680 DATA 76,238,131,169,35,3
    2,210,255,32,226,132,172,216
    ,2,32,188,2146
F6  690 DATA 131,170,224,3,16,4,
    162,7,208,2,162,6,76,238,131
    ,32,1572
EA  700 DATA 226,132,32,32,132,2
    08,16,169,44,32,210,255,169,
    88,76,210,2031
E9  710 DATA 255,32,226,132,32,5
    3,132,162,5,76,238,131,169,4
    4,32,210,1929
98  720 DATA 255,169,89,76,210,2
    55,32,208,132,208,236,32,208
    ,132,32,32,2306
43  730 DATA 132,208,6,32,208,13
    2,32,53,132,162,3,76,238,131
    ,32,10,1587
6A  740 DATA 133,32,32,132,169,4
    1,32,210,255,208,238,32,10,1
    33,169,41,1867
CB  750 DATA 32,210,255,32,53,13
    2,208,225,169,65,32,210,255,
    162,9,76,2125
07  760 DATA 238,131,169,40,32,2.
    10,255,32,208,132,169,41,32,
    210,255,76,2230
9D  770 DATA 82,132,32,29,133,14
    1,217,2,165,250,133,254,165,
    251,133,255,2374
05  780 DATA 173,217,2,48,14,24,
    101,254,133,254,165,255,105,
    0,133,255,2133
42  790 DATA 76,190,132,73,255,1
    68,165,254,132,254,24,229,25
    4,133,254,165,2758
02  800 DATA 255,233,0,133,255,1
    69,36,32,210,255,165,255,32,
    244,132,165,2571
ED  810 DATA 254,32,244,132,76,4
    8,132,32,232,132,32,29,133,1
    41,218,2,1869
61  820 DATA 32,244,132,173,217,
    2,76,244,132,32,232,132,76,2
    44,132,169,2269
14  830 DATA 36,32,210,255,32,29
    ,133,141,217,2,96,168,74,74,
    74,74,1647
40  840 DATA 32,18,133,32,210,25
    5,152,41,15,32,18,133,160,0,
    76,210,1517
5D  850 DATA 255,169,40,32,210,2
    55,76,226,132,24,105,48,201,
    58,48,3,1882
BB  860 DATA 24,105,7,96,177,252
    ,76,136,135,1,97,0,0,0,97,10
    3,1306
EB  870 DATA 0,9,97,39,0,0,161,1
    67,0,110,97,0,0,0,97,103,880

26  880 DATA 0,10,161,0,0,0,161,
    167,0,182,98,0,0,107,98,104,
    1088
05  890 DATA 0,6,98,40,0,171,168
    ,168,0,111,98,0,0,0,98,104,1
    062
95  900 DATA 0,11,162,0,0,0,162,
    168,0,2,99,0,0,0,99,105,808
77  910 DATA 0,7,99,41,0,183,163
    ,169,0,112,99,0,0,0,99,105,1
    077
56  920 DATA 0,5,163,0,0,0,163,1
    69,0,3,100,0,0,0,100,106,809

95  930 DATA 0,8,100,42,0,183,16
    4,170,0,113,100,0,0,0,100,10
    6,1086
80  940 DATA 0,4,164,0,0,0,164,1
    70,0,0,96,0,0,87,96,88,869
C5  950 DATA 0,27,0,17,0,151,160
    ,152,0,114,96,0,0,87,96,88,9
    88
4A  960 DATA 0,15,160,19,0,0,160
    ,0,0,85,95,86,0,85,95,86,886

15  970 DATA 0,16,95,18,0,149,15
    9,150,0,115,95,0,0,85,95,86,
    1063
90  980 DATA 198,12,159,20,0,149
    ,159,150,0,89,101,0,0,89,101
    ,108,1335
3D  990 DATA 0,29,101,28,0,153,1
    65,172,0,116,101,0,0,0,101,1
    08,1074
1D  1000 DATA 0,13,165,0,0,0,165
    ,172,0,90,102,0,0,90,102,109
    ,1008
CE  1010 DATA 0,30,102,56,0,154,
    166,173,0,117,102,0,0,0,102,
    109,1111
7C  1020 DATA 0,14,166,0,0,0,166
    ,173,0,6,0,2,32,5,16,9,589
41  1030 DATA 144,135,0,3,48,12,
    0,10,160,150,0,34,32,5,16,15
    3,902
7E  1040 DATA 144,135,0,3,48,12,
    0,10,160,6,0,2,32,5,16,153,7
    26
B2  1050 DATA 144,135,0,3,48,12,
    0,10,160,6,0,2,32,5,16,185,7
    58
F3  1060 DATA 144,135,0,3,48,12,
    0,10,160,6,0,34,32,0,0,153,7
    37
D7  1070 DATA 144,135,0,51,64,12
    ,0,10,0,86,80,34,32,5,0,153,
    806
98  1080 DATA 144,135,0,51,64,12
    ,0,170,192,86,0,34,32,5,0,15
    3,1078
6B  1090 DATA 144,135,0,3,48,12,
    0,10,160,86,0,34,32,5,0,153,
    822
EB  1100 DATA 144;135,0,3,48,12,
    0,10,160,63,63,63,66,82,75,8
    2,1006
CD  1110 DATA 84,73,82,84,83,83,
    69,73,67,76,73,80,76,80,80,7
    2,1235
26  1120 DATA 65,80,76,65,80,72,
    80,67,76,67,83,69,67,67,76,8
    6,1176
11  1130 DATA 67,76,68,83,69,68,
    84,89,65,84,65,89,84,88,65,8
    4,1228
41  1140 DATA 65,88,84,88,83,84,
    83,88,76,68,89,76,68,88,83,8
    4,1295
EA  1150 DATA 89,83,84,88,67,80,
    89,67,80,88,68,69,89,68,69,8
    8,1266
95  1160 DATA 73,78,89,73,78,88,
    76,68,65,83,84,65,79,82,65,6
    5,1211
78  1170 DATA 78,68,69,79,82,65,
    68,67,67,77,80,83,66,67,65,8
    3,1164
FE  1180 DATA 76,82,79,76,76,83,
    82,82,79,82,66,73,84,68,69,6
    7,1224
7F  1190 DATA 73,78,67,66,80,76,
    66,77,73,66,86,67,66,86,83,6
    6,1176
2B  1200 DATA 67,67,66,67,83,66,
    78,69,66,69,81,74,83,82,74,7
    7,1169
66  1210 DATA 80,78,79,80,162,2,
    32,198,255,160,2,32,207,255,
    145,252,2019
B3  1220 DATA 200,208,248,76,204
    ,255,160,0,32,231,255,185,11
    4,135,240,6,2549
BF  1230 DATA 32,210,255,200,208
    ,245,76,60,128,13,32,87,82,7
    9,78,71,1856
6F  1240 DATA 32,68,73,83,75,32,
    73,78,32,68,82,73,86,69,0,17
    0,1094
8E  1250 DATA 24,165,250,105,1,1
    33,250,165,251,105,0,133,251
    ,230,252,138,2453
75  1260 DATA 96,240,3,76,60,128
    ,32,180,129,32,225,136,169,1
    44,133,132,1915
A1  1270 DATA 32,5,129,162,2,32,
    198,255,160,255,200,32,207,2
    55,217,184,2325
A7  1280 DATA 2,240,247,201,0,24
    0,3,76,95,135,32,204,255,160
    ,0,177,2067
45  1290 DATA 127,133,133,170,20
    0,177,127,133,134,224,0,208,
    3,141,213,2,2125
4F  1300 DATA 169,2,133,132,32,1
    3,129,169,0,133,252,169,192,
    133,253,32,1943
40  1310 DATA 77,135,160,0,177,2
    52,208,8,230,252,177,252,208
    ,2,230,252,2620
51  1320 DATA 173,212,2,201,130,
    208,17,177,252,133,250,230,2
    52,177,252,133,2799
B7  1330 DATA 251,230,252,169,0,
    141,212,2,160,0,177,252,32,9
    ,131,162,2180
99  1340 DATA 0,189,216,2,32,244
    ,132,169,32,32,210,255,232,2
    36,214,2,2197
DB  1350 DATA 208,239,206,214,2,
    206,214,2,240,11,16,18,32,21
    0,255,32,2105
01  1360 DATA 210,255,32,210,255
    ,32,210,255,32,210,255,32,21
    0,255,238,214,2905
64  1370 DATA 2,238,214,2,169,16
    0,32,210,255,32,210,255,162,
    0,189,216,2346
27  1380 DATA 2,201,32,144,12,20
    1,34,240,8,201,128,144,6,201
    ,160,176,1890
9F  1390 DATA 2,169,46,32,210,25
    5,232,236,214,2,208,226,56,1
    69,6,237,2300
E5  1400 DATA 214,2,170,169,160,
    32,210,255,202,208,250,56,32
    ,240,255,169,2624
84  1410 DATA 0,133,254,133,255,
    224,0,240,16,24,165,254,105,
    40,133,254,2230
E4  1420 DATA 165,255,105,0,133,
    255,202,208,240,152,24,101,2
    54,133,254,165,2646
E1  1430 DATA 255,105,4,133,255,
    160,0,185,216,2,145,254,200,
    204,214,2,2334
04  1440 DATA 208,245,169,13,32,
    210,255,160,2,177,127,208,14
    ,200,177,127,2324
08  1450 DATA 56,237,214,2,229,2
    52,176,3,76,210,128,32,216,1
    28,201,147,2307
DB  1460 DATA 208,3,32,225,136,7
    6,17,136,160,255,200,185,237
    ,136,32,210,2248
9A  1470 DATA 255,208,247,96,147
    ,18,66,89,84,69,32,32,77,78,
    69,77,1644
D8  1480 DATA 79,78,73,67,32,32,
    32,32,32,32,86,65,76,85,69,3
    2,902
1B  1490 DATA 32,32,32,65,83,67,
    73,73,32,83,67,82,78,32,146,
    0,977
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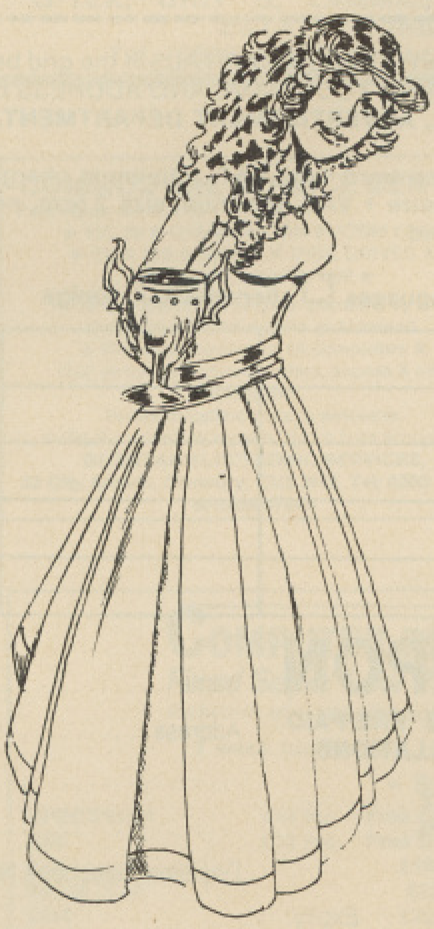
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